A COMMUNITY HEALTH MODEL TO MANAGE HEALTH HAZARDS RELATED TO MOUNT CAMEROON ERUPTIONS, WEST AFRICA

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DECLARATION

I hereby declare that this work, which is submitted here, is the result of my own independent investigation; where help was sought, an acknowledgement has been made. I truly declare that this work is submitted for the first time at this school, faculty and university, towards a PhD degree in Nursing Theory. I therefore declare that it has never been submitted to any other university, faculty or school.

Mary Bi Suh Atanga

We the undersigned declare that the study titled A COMMUNITY HEALTH MODEL TO MANAGE HEALTH HAZARDS RELATED TO MOUNT CAMEROON ERUPTIONS, WEST AFRICA is originally produced by the student, Mary Bi Suh Atanga, student no. 2004163669.

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DEDICATION

To Mama Catherine Lum Suh, my late mother.

ACKNOWLEDGEMENT

ABSTRACT

Mount Cameroon is one of Africa's largest and most active volcanoes, the last eruption occurring in 1999-2000. Communities in close proximity to this mountain were and could again be adversely affected by such volcanic eruptions. The goal of the study was to develop a community health adaptable model for the management of health care related hazards – not only for this community, but also for others within Cameroon and Africa.

An exploratory qualitative approach to data collection and analysis was used in order to gain insight into what would be acceptable to the community. Purposive sampling was used to identify three groups of community members and a group of health care workers who have lived through a previous eruption (who turned out to be nurses and nurses' aids only). Data was transcribed, notes made among researcher and assistants and cross-matched to arrive at occurring themes. The significance attached to the mountain and its eruptions, management strategies from the perspective of the community members and an identification of what matters most in this regard were elicited. An analysis of documented evidence from local resources focused on the realities of such a hazard, prevention and mitigation measures, as well as adaptable methods that could inform the model. The exploration of international relevant strategies in managing natural disasters in general, and volcanic disasters in particular, as well as a literature review, was conducted. The findings were triangulated to inform the development of an adaptable model.

After an exploratory pilot study (pretest), using members of another community that was affected to some extent during the 1999-2000 eruption, two participant focus group discussions were held with each of three groups of community members. These included a group of elders, men and women. The findings indicated that community members regarded the mountain as a god to be appeased. Thus, some of the cultural practices exposed the community even further to hazards related to a volcanic eruption. They emphasised the protection of women and children, had some traditional health care actions in place, respected the local council for its important role, but thought that their role was marred by limitations such as infrastructure and resources. They were concerned about any evacuation process and confirmed previous negative experiences

in this regard. Focus group discussions with a group of health workers indicated a slightly more scientific view of the eruptions and emphasised the livelihood value of the fertile soil surrounding the mountain. The group expressed concerns regarding cultural practices and the severe lack of health care infrastructure and resources, and expressed limited management strategies to deal with a health hazard of such magnitude.

Documented evidence and literature was limited, but it was found that within Africa, concerns were similar. Management strategies were linked to a number of government departments' involvement and scientific research and monitoring done by academic institutions or other facilities. Internationally, a number of directive frameworks exist but the need for an in-country framework, incorporating the needs of local communities, is emphasised in some models and approaches.

Triangulation of focus group results, and an analysis of local and national documented evidence and international literature, indicated that a critical need exists to focus on the community's intricate relationship with the mountain (inclusive of cultural and religious practices), the involvement of community members as critical role-players, the enhancement of health care services, the development of the knowledge and skills of health care workers, and addressing or even simplifying the complex nature and directives on national level to deal with such emergency situations. These five major focus areas form the basic tenets of a community adaptable model that values being, belonging and becoming. In this way, community members are active participants in assessment, planning, implementation and evaluation.

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ABBREVIATIONS USED

AIDS: Acquired immunodeficiency syndrome

ARGV: Unit for Geophysical and Volcanological Research

ATLAS/Ti: Software package for qualitative research

CDEM: Civil Defence Emergency Management

D.O.:   Divisional Officer

DDES: Department of Disaster and Emergency Services

DRC   Democratic Republic of Congo

FGDs: focus group discussions

HIV: Human immunodeficiency virus

ibid: Same author as above

IEC: Information education and communication

INETER: Institute of Territorial Studies CDEM: Civil defense emergency management

IRGM: Institute of Mining and Geological Research

ITU:,IARU:,WGET: Arms of the United Nations

Km   Kilometers

M   meters

MINATD: Ministry of Territorial Administration and Decentralization

NGC: National Geological Council

NHSP: National Health Strategic Plan

NSC: National Scientific Committee

PCC: Provincial Crisis Commission

POEM: Portland Office of Emergency Management

PRA: Participatory Rural Appraisal

SAMU: Emergency Medical Assistance service

SWOT: Strengths, weaknesses, opportunities and threats

UNDP: United Nations Development Plan

UNDRO: United Nations Disaster Relief Organization

UNO: United Nations Organization

USGS: United States Geological Survey

VDAP: Volcanic Disaster Assistance Program

CHAPTER ONE
AIM OF AND RATIONALE FOR STUDY

1.1   Introduction

Humans have settled within the shadows of active volcanoes from the earliest periods of civilisation to date. Volcanoes provide fertile soil for agriculture, impressive tourist sites, mineral wealth and hydrothermal power (Dominey-Howes & Mino-Minopoulos, 2004: 144). They very often cause fear, loss of life and impairment. The 1999-2000 eruptions of Mount Cameroon, West Africa, were characterised by widespread ash fall which caused eye, skin and respiratory irritations, as these conditions were found to be common in most healthcare consultations during that period (Afane, Coco, Ndjolo, Afane, Doung & Muna, 2000). Other health hazards identified by the Provincial Crisis Committee (1999-2000, Report of Provincial Crisis Committee, March 1999) included volcanic hazards like pyroclastic fallout materials (in the form of dust particles), gases inhaled and burns from lava flows.

An erupting volcano can have consequences ranging from a short-lived inconvenience to normal activities, to loss of life and property, to having a negative influence on the quality of life in the long term. As a result of such, recommendations were made by the Provincial Crisis Committee to address both short- and long-term needs and priorities. These included the setting up of a Provincial Crisis Commission and the National Scientific Committee; the evacuation and resettlement of populations considered to be within the high risk zones; creating educational programmes on awareness of natural hazards for persons living in areas prone to eruptions; systematic and continuous control of food and water used by affected populations; and continuous field and aerial observations of the eruptions. It seems that these short-term recommendations have not been implemented, probably due to some policy implications such as committing budgetary allocations and political commitment to the course (Ayanji, 2000: 21). It thus seems clear that communities need to be empowered by being informed and being enabled to support themselves in the face of such an eruption. The importance of studies such as this cannot be refuted in such circumstances.

1.2   Background

Mount Cameroon is the highest mountain in West and Central Africa (4 095 meters) and lies on the coast of the bight of Biafra in the gulf of Guinea. It is located at 4.203N and 9.17E (Smithsonian Institute Global Volcanism Program, 1999: 3), and is prominent along the Cameroon volcanic line (Appendix 1: The Cameroon Volcanic Line). More than 15 villages (communities) are situated on the slopes of the mountain, with different villages affected by different eruptions in different ways over the years (Appendix 2: Map of Mount Cameroon showing two eruption sites and surrounding villages). Psychologists, volcanologists and members of the health team have observed that information needs to be obtained to assist such communities. Particular emphasis is placed on the need for the development of individual, community and organisational mitigation models (strategies to control effect of a danger, such as effective communication) (Paton, Ronan, Johnston & Houghton, 1997: 1).

While volcanic hazards such as ash fall and lava flows are essentially immutable, some of their consequences for communities, businesses and individuals are more amenable to moderation through disaster reduction or mitigation, particularly when dealing with so-called non-catastrophic eruptions. Equipping communities with a management/mitigation model becomes a possible short-term solution.

In the development of any aid strategy, it has been discovered that resources are required to manage the disaster (CDEM, 2002: 1). For example, the strategies involve designing roofs to better withstand ash fall, encouraging adoption of protective measures to minimise ash effects on health, covering drinking water sources, safeguarding essential utilities like electricity transmission, developing business continuity plans and equipping the community with emergency models/strategies (Paton,Smith, Daly & Johnson, 2008: 2). Facilitating the effective adoption of these strategies requires several groups (including volcanologists, social scientists, emergency managers and community representatives) to collaborate to identify needs and develop solutions to address these needs and to mitigate health and social vulnerability. The reason why close collaboration with the community is necessary relates to finding the best model to suit the particular community.

The fertile soil of post-volcanic eruption sites attract people and residents from over 15 villages located on and around the mountain. These people are very vulnerable to eruption hazards. The community members have maintained their villages with no thought of moving, even when the government declared the area a disaster-prone zone. Hundreds of thousands of people live on the flanks of Mount Cameroon and are dependent on the rich agricultural land and springs from the volcano which provide fresh drinking water. These people live in the fifteen villages that surround the Mountain (Sparks, 2005: 1). The Bakingili community is one of these villages and is made up of approximately 4000 as was recorded by the Provincial Crises Commission during the 1999-2000 eruptions. Eruptions have been recorded in 1909, 1922, 1949, 1954, 1959 and 1982 (Fitton, Kilburn, Thirlwall & Hughes, 1984: 328).

In 1984, because of the interest shown by the scientific community during the 1982 eruption, the Ekona Unit installed the first seismic network for Geophysical and Volcanological Research (ARGV) of the Cameroon Mining and Geological Research Institute (IRGM) (Ambeh, Fairhead and Stuart, 1988: 3). The researchers of this institute met with academics, administrators and health experts to discuss possible strategies to manage the effects of an erupting volcano when it occurs. During these meetings, plans were made to address a number of eruption hazards on an ad hoc basis, but the need for more permanent structures, models and/or programmes to help communities in difficult times was probably neglected.

The National Health Strategic Plan (NHSP for Cameroon) recognises the need to give assistance to affected communities in the event of eruption (NHSP, 2001: 324), but very little, if anything, has been put in place for community use. Meanwhile, the Portland Office of Emergency Management (POEM, 2004: 1) was put in place in Mexico and its neighbouring countries to coordinate residents' ability to make long-term plans to address an emergency situation and to avoid having to act spontaneously when an eruption occurs. However, the plans do not address a particular disaster, village or community, which means that they could or may be adapted to eruptions and other disasters in other places.

The Bakingili community located on the south-eastern slope of the mountain was affected in 1999 and 2000. During the eruption of 1999, the principal vent at

approximately 1 500 meters (m) elevation initially sent a voluminous flow in a south-south-west direction through dense rainforests towards the village of Bakingili (Nni, Katabarwa and Lockwood, 1999: 1). The flow of alkalic basalts eventually extended 6-7 kilometers (km) from its source vent and cut (blocked and melted away) about 80 m of the important Limbe-Idenau road on the 15th of April, 1999. As of late April, 1999, around 400 evacuees from Bakingili, who were still being housed in a nearby refugee camp but expected to be allowed to return home shortly, and who did return, constituted the population that was used in this study.

The issue of planning and implementing an emergency plan requires that the cultural and social complexities of a community be taken into consideration, rather than examining the risk of a volcanic eruption from a natural science perspective only (Marcias & Aguirre, 2006: 60). It is important also that the district health service assist in the process. Therefore, it is critical to address the management of volcanic emergencies in a way that is scientifically meaningful as well as acceptable to the surrounding communities.

The District Health Service System is used in Cameroon (Monekosso, 1990). The communities within each district are found within the health areas of that district. Bakingili is in the Batoke Health Area of the Limbe Health District (Appendix 3: Limbe Health District and Health Facilities). In this system, the point of implementation of health services is the district which is further divided into health areas. The health workers of this district were constituted another part of the population that was studied.

1.3   Problem statement

Mount Cameroon is one of Africa's largest and most active volcanoes. With a height of 4 095 m and a volume of 1 200 km^3, it is a constant reminder to the over 100 000 people who live on its slopes that the need for risk and health assessment, the understanding of community views on eruptions, community resilience and health education strategies cannot be overlooked. Mount Cameroon has erupted at least seven times during the previous century (Suh, Sparks, Fitton, Ayonghe, Annen, Nana and Luckman, 2003: 267), the most recent being the 2000 eruption (Appendix 4: Positions of eruptions and lava flow during the 20th century). Volcanic ash and gases from the

eruptions were carried downwind for over 10 km. Several settlements lie in the path of these emissions. The residents of these settlements have suffered frequently due to emergency displacement, as well as from the accompanying fear, panic and public disorder.

The long-term lung, skin and eye hazards have not been studied, despite the fact that ash falls have been found to be a health hazard in other parts of the world. This has been proven in the characterisation of respirable volcanic ash (Horwell, Sparks, Brewer, Llewellin and Williamson, 2003: 347) in which the health effects of inhaling these constituents have been identified. Creating awareness of such hazards, handling fear, panic and alarm and the ability of the communities to cope with a major volcanic disaster in the region (before the arrival of health relief) has not been scientifically assessed scientifically. The Provincial Crisis Commission (1999-2000) recommended educational programmes on natural hazard awareness, such as the avoidance of steeply sloping topography, staying away from poorly constructed buildings, moving out of buildings in an orderly manner, keeping away from explosive eruption vents, avoiding proximity to eruption fissures, avoiding the outdoors during ash falls (refraining from staying out in the open for too long except during tremors), among others. However, the way these communities view 'their' mountain, values attached to the mountain, local ways of handling their difficulties and the way they may view these recommendations still has not been assessed to adequately recommend acceptable strategies/ management approaches. For any successful work in communities, the specific needs and perceptions of ethnic communities must never be overlooked.

Furthermore, Horwell and Baxter (2006: 192) recommend that a more systematic approach to multi-disciplinary studies in future eruptions cannot be overlooked. It is important to remember that Mount Cameroon is similar to volcanoes such as Lake Nyos and Lake Monoun. For example, in 1986 the sudden release of CO_2 from Lake Nyos killed over 1 700 people in less than a day, making it the worst volcanic gas disaster in living memory (Baxter & Kapila, 1989: 268; Stupfel and Le Guern, 1989: 249). Faced with such an uncommon phenomenon, the community was handicapped completely and the health sector struggled to assist meaningfully. The end result was increased loss of life. The possibility that a disaster of this nature related to the activity of Mount Cameroon can arise is real and the communities may still be handicapped. Mitigating

volcanic hazard effects is not impossible (Paton, Ronan, Johnson & houghton, 1997). The model (volcanic hazard effect mitigation) directs the health planner to additional information that is required when persuading people of the particular community in hazard mitigations. It takes into consideration all that a community perceives and feels about the mountain, its actions and the health strategies/programmes to be put forward.

In reflecting on volcanic emergency management systems and programmes, it has been noted that chronic problems between the various parties involved do exist, or that some important flaws are present (Marcia & Aguirre, 2006: 45). These relate to, for example, not considering cultural and social complexities in the developing world and the absence or lack of expertise and the absence of public warning systems (Nigg, 1987: 54).

In the experience of the researcher, planning for, and the management of emergencies related to Mount Cameroon volcanic eruption hazards are problematic and disconcerting. Community members may have specific religious and cultural beliefs that may be in conflict with modern emergency disaster management approaches. Also, organised responses to previous eruptions of Mount Cameroon limited community involvement in the planning and execution of such responses.

1.4   Goal

The goal of the study was to develop an adaptable community health model (an acceptable strategy that is scientifically based) for the management of healthcare related hazards of Mount Cameroon volcanic eruptions. A qualitative approach to data collection and analysis was used, with the aim of gaining insight into what would be acceptable to the community. The following research questions guided the study:

- What are the understanding, cultural practices and values he community members attach to Mount Cameroon and its eruptions?
- What, in local opinion, should be part of a model or plan that guides behaviours in the event of a volcanic eruption of Mount Cameroon?
- How did health workers respond to the past eruptions?

- What successful approaches have been applied internationally with regard to disasters in general and volcanic eruptions in particular?

- How best can the success stories and local cultural practices and behaviours be blended to produce scientifically sound and culturally acceptable mitigation processes in the event of an eruption?

1.5 Objectives

The objectives of this study were to:

- Determine community members' and health workers' understanding, cultural practices and values related to Mount Cameroon volcanic eruptions.

- Analyse community members' and health workers' choice of emergency management behaviours in the event of volcanic eruptions of Mount Cameroon.

- Analyse health workers' management strategies, as documented, to deal with the volcanic eruptions of Mount Cameroon at local and national level.

- Explore relevant management strategies from international literature on natural disasters in general and volcanic disaster management in particular.

- Develop an adaptable model for managing healthcare related hazards of Mount Cameroon volcanic eruptions through methodological (logic deductions) and data triangulation methods.

1.6 Conceptual framework guiding the study

Nursing science and related theory has often been described as the conceptualisation of an aspect or part of reality (invented or described) that pertains to nursing (Meleis, 1997: 16). Such conceptualisation is articulated for the purpose of describing, explaining and predicting a phenomenon and/or approach and related factors. In this study, the Mount Cameroon volcanic eruptions were described and explained and, where appropriate, predictions surrounding such events were made. The study included input from both health workers and community members as related to Mount Cameroon and within the context of its outbursts and accompanying hazards. The behaviour or actions in the event of a threat, and the way the community and health workers plan for such emergencies, were studied carefully.

Documented evidence was used to cross-reference and ascertain any predictions. For instance, in 1999-2000, the Ekona (Cameroon) unit for Geological and Volcanological Research (ARGV) of the Institute for Mining and Geological Research (IRGM), together with the local university (University of Buea, Cameroon, Geology Department) was monitoring the activities of the mountain (Smithsonian Institute Global Volcanic Program, 1999: 4). The necessity of an early warning system for Mount Cameroon has been suggested (Gaudru & Takouankoue, 2000: 2) but holistic or comprehensive studies and approaches have not been used to guide the development of meaningful strategies to manage health hazards of the Mount Cameroon eruptions. To pursue a comprehensive approach, the triangulation of data from multiple resources to develop such an adaptable community model (emergency plan) was considered meaningful.

Figure 1.1 illustrates the five objectives of the study and indicates the perceived relationship between the objectives**.**
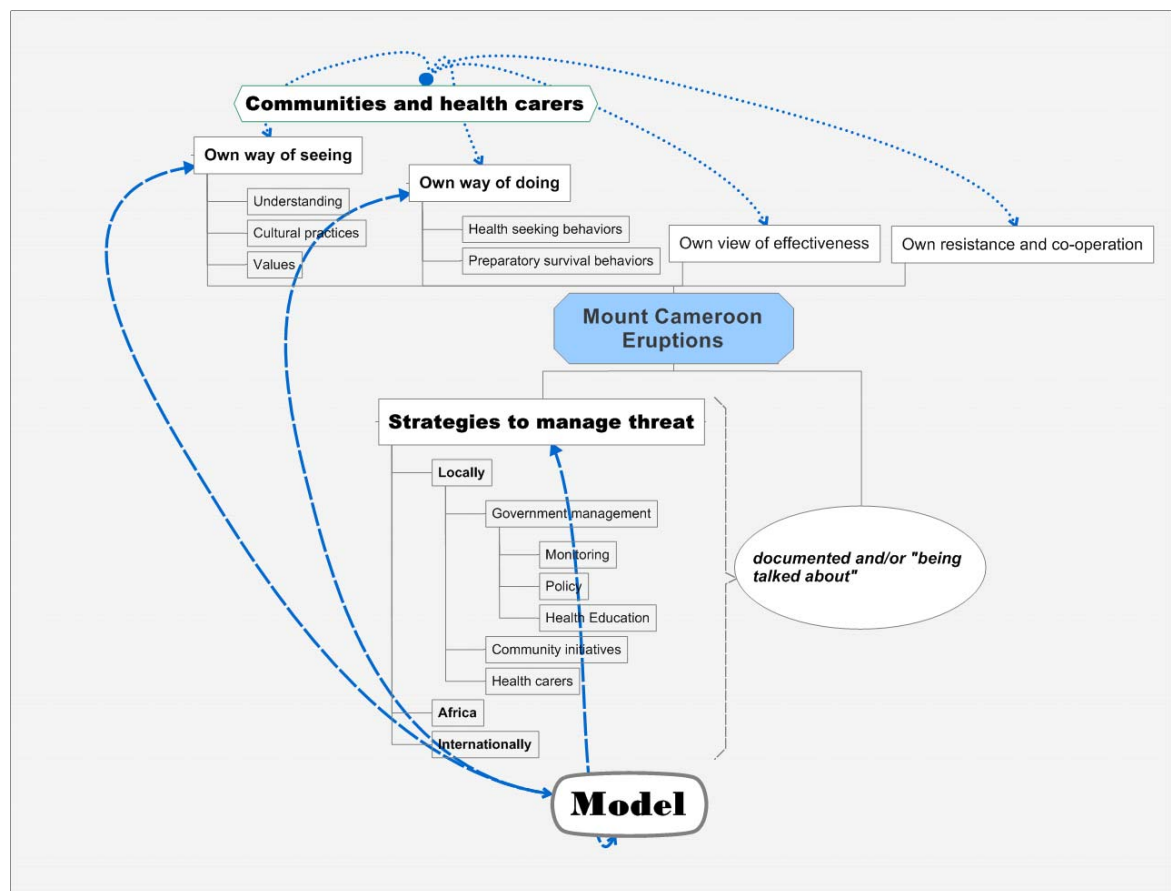
Figure 1.1: Conceptual framework guiding the study

The community adaptable model that was developed (step by step model-chapter seven) was intended to address the unique needs of an ethnic group that has been overlooked often in the planning and implementation of prevention or mitigation plans. The conceptual framework guiding the study recognises the fact that the community's own way of seeing the mountain (understanding, cultural practices and values), their own way of doing when the mountain erupts (health-seeking behaviours and preparatory survival behaviours), their own views on how effective the systems are (their own behaviours and actions of the scientific and health sectors) and their own resistance and cooperation (among themselves and with scientists), all play an important role in dealing with the realities of the mountain when it erupts.

The local (Cameroonian), African and international strategies were then combined with these views to arrive at an adaptable and acceptable model from which a meaningful emergency plan could be developed for community use.

1.7   Conceptual and operational definition of concepts

1.7.1   Health hazard
Within this study, 'health hazard' refers to a form of real or potential harm that arises from the possible and/or real impact of volcanic eruptions. This is in line with Chester (2002) volcanic assessment views. The views of community members on what constitutes such hazards were considered. Everything that causes fear, loss of life and impairment was sourced from the community members as health hazards.

1.7.2   Mount Cameroon eruption
Mount Cameroon is an active Hawaiian to strombolian (shield) volcano of Quaternary origin, with a summit crater, subject to continued fissure eruptions on the flanks of the mountain (Payton, 1993: 3). The activities may be in the form of tremors, lava flows (eruptions) or earthquakes. These activities are not limited and the effects may be long lasting.

In this study, all activities of the mountain, namely pre-, intra- and post-eruptions, were considered, including the outburst of lava from the mountain following tremors.

1.7.3 Community

A community can exist only when a group of people defined by geography or affinity engages in social interaction, builds ties, exhibits awareness of identity as a group and holds direct access to and participation in collective decision making (Hancock, Labonte & Edwards, 1999).

The community being studied here is taken to be the confines of a locality that houses people who interact with one another, attend meetings within the locality and show that they belong by having long-standing ties with the community.

1.7.4 Community health

Community health refers to the ability of a community to generate and effectively use assets and resources to support the well-being and quality of life of the residents of the community as a whole, in the face of challenges and barriers within the context of their environment (Ryan, Nicholls & Racher, 2004).

Community health in this study refers to the way the community joins efforts in solving identified health issues or problems, including health-seeking behaviours.

1.7.5 Community health model

A community health model has the ability to merge the community development process with a compatible community assessment, planning, implementation and evaluation framework, i.e. doing the right things in the right way (Annis & Racher, 2005). Such a model usually takes material from various sources into consideration, using triangulation as a critical element in the practice of social science, adding one layer of data to another to build a confirmatory edifice (mountain of information) (Flick, 1998: 178).

The focus of the community health model in this study was on an approachable and practical framework that is acceptable to and can be used by a community, literate or not, to manage health threats when a natural disaster in general or a volcanic eruption in particular occurs.

1.7.6   Health worker

A health worker is any person who is involved in the care of client. These could be nurses, doctors, laboratory scientist, nurse aids, or any locally trained individuals for specific health task (Slepski, 2007; Palumbo, Rambur, Mclntosh & Naud, 2008).

In this study health workers referred to were nurses and nurses' aids.

1.8   Research design

An exploratory study was conducted using qualitative research methodology. Qualitative research has proven its value in studying complex phenomena (Reger and Pfarrer, 2007). It is meaningful in the rigorous exploration of many issues of interest which are difficult to study (Mason, 2004a, Flick, Kardoff & Steineke, 2004, Morris, 1994; Carley, 1993; Woodrum, 1984). Qualitative research methodology benefits from the work undertaken in a range of disciplines (Miles & Huberman, 1994; & Tesch, 1990). It is based on the premise that the knowledge and understanding of human beings are possible through the exploration of their lived experiences as defined and related to by the actors themselves. This provides insight into the matter at hand through a process of discovering the meaning attributed to certain events or issues, and leads to an understanding of the whole (Polit, Beck & Hungler, 2000: 82).

Research on Mount Cameroon (the area that houses the research population studied) has been limited to geo-dynamism studies with very limited documentation of the communities' views of the mountain and its activities. Health-seeking behaviours following the identification of health hazards may vary from person to person, or from community to community. Therefore, the researcher used focus group discussions with both community members of the Bakingili community (situated on Mount Cameroon at the south-eastern flank) and with health workers. The documented evidence as related to Mount Cameroon was analysed qualitatively and a critical analysis of international literature to meet the objectives of this study was conducted.

The following specific research strategies as related to the objectives were used:

1.8.1 Research strategy for Objective 1 and 2

The focus group discussion method is widely used currently, especially in research that relates to culture and belief patterns. The choice of focus group discussions (FGDs) is meaningful as it provides a platform for participants to meet, interact, explore the matter at hand and gain insight into their own thoughts or the thoughts and ideas of others. The observation of, for example, patterns of interaction and verbal and non-verbal behaviour convey meaningful information helps to understanding of the relevant phenomenon (Greenbaun, 2006: 10). In FGDs, dimensions of understanding that may often remain inaccessible by other data collection techniques can be discovered (Burns and Grove, 2001: 545). The expectations of the participants were considered an important aspect of the study for an adaptable model to eventually emerge (Chiu & Knight, 2002).

Four participant focus groups were used to elicit information as required. Two focus group discussions were conducted with each set of participants (elders, men and women from the community and with health workers) until saturation point was reached and no new data surfaced. The separation of these members was guided by the fact that men may not be allowed to talk freely when with elders and the same for women when with men or elders. Health workers required a separate set of questions that were based on healthcare management and their observations of community health-seeking behaviours.

- Does the mountain signify any thing to you? /what is the meaning of the mountain to you?
- What immediate activities did you engage in when it was erupting?
- How did the community members take care of themselves?
- Was there co-operation among you and the community in health activities?

1.8.1.1 Unit of analysis

All Bakingili community members and health workers of the entire health district who had witnessed at least one Mount Cameroon eruption constituted the population for the research. This was guided by the fact that the rich agricultural environment enables health workers and their families to stay in the area and makes it less likely that they will request transfer to another area. Participants were recruited using a purposeful

sample method. Purposeful sampling is meaningful, since it allows inclusion of participants equipped with full knowledge and/or experience of the issue under study (Mason, 2004a: 134). For this reason, participants must have experienced at least one Mount Cameroon activity (eruption) and were at least 18 years of age at the time of the activity. The total population of the community is approximately 4000, made up of men, women and children. Of this population, less than one percent of those who have lived one eruption experience in permanently in the community (chiefs' experience). This was due to rural exodus to the nearby cities of Limbe and Douala. From the Sunday meetings, it was observed that approximately ten members of each meeting group (men, women, and elders) had lived one eruption experience. Out this number, the first five – eight volunteers who were to arrive the arranged venue on strictly on the stipulated time (16:00). A total number of six elders, five men and women respectively reported and took part in the discussions. The frequency of utterances constituted the unit of analysis for FGDs.

1.8.1.2 Exploratory FGD

A pilot (pretest FGD) serves as a so called "test run" that contributes meaningfully to validity. Such an exploratory phase of a study is a miniature prototype of the planned research intervention (Prescott & Soeken, 1999: 6) and provides the opportunity to determine the value or usefulness of the research instrument and/or focus group guides.

It also provides the researcher with experience on the management of the research strategy and an opportunity to refine the process (Burns & Grove, 2001: 50). The aim is to help the researcher to assess the developed guidelines, the efficiency and effectiveness of the recording methods and issues around time management of discussions. It is also useful in fine-tuning the training of research assistants (FGD questions).

The exploratory FGD was conducted within the Bokwoango community, which is some 40 km away from the study site but which was also affected by the 1999 Mount Cameroon eruption. One group discussion with five to eight members (volunteers) was used at each session. Two sessions for each community group and one for the health worker group, making a total of seven sessions were conducted on different days. The principal investigator and research assistants proceeded with the introduction of the

topic, obtaining informed consent (Appendix 5) and the phrasing of the opening question and follow-up questions:

- What are the understanding, cultural practices and values attached to Mount Cameroon and its eruptions?

- What, in own opinion, should be part of a model/plan or behaviours in the event of a volcanic eruption of Mount Cameroon?

The discussions were audio-taped and notes were taken by the assistant researcher and the principal researcher. The audio tapes and notes were translated into English and the member responsible for the transcription validated data with research team members (the social scientist and health statistician) to ensure the trustworthiness of the translation.

Before the exploratory FGDs pilot study began, field assistants were trained in several other communities away from the Bokwoango and Bakingili communities until they were well-versed in the requirements of good interviewing (for example remaining neutral at all times, using probes for continuation of discussions, no coercion but encouragement to talk, among others-Wilkinson, 2004:108). The community groups used for the pilot study had sound knowledge of Mount Cameroon eruptions. Such community groups were easy to obtain, since the phenomenon under study is a common course of concern, often discussed, and the mountain is a real presence in the daily lives of all surrounding communities.

1.8.1.3 Data collection and analysis

During data collection, the focus of any study must be ultimately translated into phenomena that can be observed and recorded and be used to promote social action (Pepall & Earnest, 2006). The Mount Cameroon eruption phenomenon and planning for its management can be better understood by collecting data on the views of the inhabitants and health workers involved and/or exposed to the phenomenon. The views, actions, perceived effectiveness of actions as well as resistance among and cooperation between role-players were considered important for reflection purposes.

Within the said communities, it was considered important to encourage free interaction. This was enhanced by using four different groups where more importantly, peer group

and gender were taken into account. Free interaction was facilitated by utilizing different groups in line with local customs and practices (Wilson, 2008). For instance, a man may not have been comfortable talking about cultural patterns in the presence of elders; the same would apply for women in the presence of men and elders. Thus, the four groups used were elders, men, women, and health workers. The first five to eight members who volunteered during and met the inclusion criteria during one of the Sunday meetings were requested to participate. Five to eight group members are considered meaningful to facilitate discussion (Gillies, 2003: 121). It is a custom in the area for men, women and elders (being old and/or influential men) to hold Sunday meetings to discuss some community needs. Thus, volunteers were enlisted at this time and the date and venue arranged for the FGDs.

The prescribed venue and time were arranged to suit all participants. For instance, the Chief's palace was used for elders, a suitable home for women (the normal meeting venue on a non-meeting day), and another for men, and the health centre for health workers. When the participants met, they were requested to sign a consent form (Appendix 5) after receiving clear information on the objectives and approach used in the study, as well as the ethical guidelines followed.

The participants' identities were protected by using minimal biographic data such as gender, age and signature (on consent form only). The discussions lasted around 60 to 80 minutes during the first sessions and were reduced to between 40 to 60 minutes during the second set of discussions as soon as saturation was reached. The second focus group discussions were for the purpose of clarification, reviewing, saturation and adding further information if necessary.

As with the exploratory FGD, the principal investigator and assistant researcher (a trained social scientist cross-checking notes from tapes). Discussions were conducted in the local language- pidgin, and were audio-taped and notes were taken by the trained assistant and the researcher. The audio-tape recorded interviews were and notes verbatim transcribed and then translated into English. Research team members did random checks to ensure trustworthiness of translation.

1.8.1.4 Strategies to enhance trustworthiness of the study

Trustworthiness relates to the truth and value of findings. It focuses on the credibility of the data and the transferability of findings. Credibility refers to confidence in the truth and the interpretation of the data (Polit & Beck, 2004: 430). Credibility can be obtained by prolonged engagement and persistent observation. The degree to which the data can be transferred to other settings by another researcher is known as transferability, which ensures trustworthiness. In this study, the pretest study was used to test the FGD question guideline and other matters related to the focus group. Furthermore, prolonged engagement with participants with the same focus throughout the discussion session clarified points that were discussed previously thus enhancing trustworthiness. Prolonged engagement provides scope, while persistent observation provides depth (Lincoln & Guba, 1985: 304).

An experienced qualitative researcher from the Faculty of Social and Management Sciences (research assistant), University of Buea, analysed a sample of transcribed interviews. Both the principal investigator and assistant researcher independently listened to the audio tapes, reviewed the transcription and translation and independently identified themes. Findings from this process were then compared.

1.8.2   Research strategy for Objective 3

Careful analysis of existing documents was undertaken to achieve this objective. Some researchers use the review of existing data in their studies (Polit & Beck, 2004: 37), which is often considered as analysis of records. Records are available as written or typed documents and the study and analysis of such data is referred to as content analysis. Babbie, (no date) defines content analysis as the study of recorded human communication, such as books, websites, paintings and laws. According to Holsti (1999), content analysis is any technique for making inferences by objectively and systematically identifying specified characteristics of messages. These messages could be in public documents such as minutes of meetings and newspapers or could be private documents such as journals, diaries, letters and e-mails (Creswell, 2003: 187). This is because a major part of reality that is relevant to members of modern societies is accessible to people in the form of documents. The increase in their significance is due to the secular trend towards the legalisation and organisation of all areas of life (Wolff, 2004: 284).

Content analysis is a standard methodology in social sciences and is the critical and scientific summarisation and analysis of data (Mason, 2004a: 71; Creswell, 2003: 188). Examples of foci in the analysis of this study were to note recurring concepts and phrases related to health hazard management and the context in which they were used. The descriptions of actions or activities, successes, failures and relevant statistical data, if any, were also scrutinised carefully.

1.8.2.1 Unit of analysis

In this study, all the occurring themes around the nature of eruptions, management of their hazards, success stories and challenges found in the documents available and accessible constituted the units of analysis. The content was analysed primarily to inform the researcher on the history of the eruption, management strategies, perceived successes and failures. The collection and examination of documents are often an integral part of qualitative research. During such analysis, categories, sub-categories and/or themes emerge (Springer, 1998), thus, like in Richards (2005: 32), the envisaged categories related to viewpoints, knowledge of the phenomenon, strategies and mechanisms used, actors involved and successes and failures as emerging from the documents constituted the units of analysis. The documents were selected by cross-checking with the social scientist for enough evidence of inclusion and meeting the inclusion criteria.

1.8.2.2 Data collection

The aim of the data collection was to include all relevant documents and to survey them comprehensively using content analysis. The data collection was done according to a three-staged strategy. Firstly, local documents from the local research institutes were used, secondly the reports of local commissions and committees were explored and thirdly the ministerial departments and local health documents were reviewed.

1.8.2.3 Strategies to enhance trustworthiness of the study

Trustworthiness in content analysis often relates to the validity and reliability of the content as presented; being true reflections of what transpired, thus reflecting the reality of the event. The basic phases of data collection, coding, content analysis and interpretation of findings introduce also unique validity and reliability concerns (Weber,

1990). In using content analysis, the researcher should examine sources of data carefully and identify, for example, themes, theoretical stance(s) and approaches.

In this study, trustworthiness was ensured by the scrupulous use of the content analysis process - search for the occurring themes in the documents (local African and international). Examples are identifying the type of data, the boundaries of analysis, possible inferences, similarities and differences between statements and documents, perceived value and/or effect of documents.

1.8.3   Research strategy for Objective 4

A content analysis of international management strategies was undertaken to achieve this objective. International literature was analysed by equally searching for the themes as relevant to the study, utilising qualitative research techniques of using words like – 'most of the document----' rather than numbers. Although the implementation of content analysis varies considerably, there are commonalities in the methodology that cut across various approaches (Fielding & Lee, 1998; Carley, 1993). An attempt was made to determine the relationship(s) between two or more management strategies found in various sources of literature. Content analysis provides also a valuable tool to access deep individual or collective structures such as values, intentions, attitudes and even cognitions (Carley, 1997; Kabanoff, 1996; Huff, 1990). What was observed in the document was use, thus employing manifest and not latent content analysis.

Content analysis of relevant literature was carried out using specific subsets of data such as principles applied, methods used in identifying problems and solutions and strategies implemented (Reger & Pfarrer, 2007: 5) in the management of disasters in general and volcanic eruptions in particular. The researcher specifically analysed literature that focuses on healthcare strategies that were used internationally to deal with disasters in general and volcanic eruptions in particular. Such literature informed the development of the model as it provided information on contemporary strategies developed in various contexts. Furthermore, it provided insight into adaptive approaches and processes that were successful in developing countries similar to Mount Cameroon and its communities. After reflecting on a number of such documents, the researcher analysed data on the nature of the volcanic eruption, its monitoring, preparation strategies to avoid harm, effectiveness of these strategies, lessons learnt,

cooperation and resistance, and change management. These contributed to an adaptable model for the Bakingili community (Chapter 7).

1.8.3.1 Unit of analysis and data collection

International literature on the nature, programmes, activities, case studies, policies, emergency management and other related publications on natural disasters in general and volcanic disasters in particular were scrutinised. Marcias & Aguirre (2006: 45) are of the opinion that little if any limitation should be placed on the number and types of sources used, taking into consideration that most strategies of this nature are beset by public policy. The researcher identified emerging themes and categories from sourced material, for example, the nature of the problem as described in the literature, reactions of local indigenes, actions of the health sector and other collaborators, local perceptions of the problem and management strategies.

1.8.3.2 Strategies to enhance trustworthiness of the study

Credibility was achieved by ensuring that only international literature that relates to the phenomenon under discussion or similar disasters was considered. According to Huff (1990) and Weber (1990), reliability in content analysis is seen when groups of words are occurring and re-occurring, revealing underlying themes. Co-occurrences of keywords can be interpreted also as reflecting associations or relationships between concepts.

Trustworthiness within the content analysis process was ensured by reflecting carefully on the occurrences and contexts of concepts/themes as they emerged within relevant sources and by using more than one research assistant (social scientists) to separately and independently study the same documents, make observations of the occurrences, and compare with the researcher. The occurrences and re-occurrences of keywords and phrases were grouped as categories that indicated possible associations between these concepts.

1.8.4   Research strategy for Objective 5

Triangulation is a rich method of dealing with the outcome of complex but structured data collection processes (Polit & Beck, 2004: 432). The concept of triangulation is used often to indicate that more than one method is used to confirm findings a second

and/or a third time, but can be used also to bring together diverse views on the phenomenon under study (Flick, 1998: 230; Gephart, 1993: 1466; Cohen & Manion, 1986: 254). It aids meaningful reflection from more than one vantage point (Flick, Kardoff & Steineke, 2004: 178) and is considered to cross examine and to add to confidence, rigour and trustworthiness in findings. By combining multiple observers, theories, methods, empirical materials, and cross-checking, a researcher may overcome intrinsic biases and problems common to many single-method, single-observer, single-theory studies (Krippendorf, 2004:64).

In this study, it was assumed that a cross examination of data from all the FGDs, locally produced documents and international literature on disasters in general and volcanic eruptions in particular should provide room for the required themes and categories to emerge and inform the envisaged adaptable model, thus providing for a richer and more informed model, one that considers cultural beliefs and scientific stance.

1.8.4.1 Unit of analysis

In this study, findings from the focus groups (health workers and community members), local documents and international literature were triangulated to interrogate the issues at hand, and reflect on the nature of the hazard, management (including prevention and mitigation strategies), challenges and recommendations.

The model that emerged benefited from the inputs of the community concerned and documents to develop and apply health management strategies that would be acceptable to all role players and with due consideration of contemporary management strategies used in Africa and internationally. It was anticipated that the model would strengthen the community's ability to deal with such an impact and to develop community resilience, i.e. the ability of a community to respond to adversity and, in doing so, reach a higher level of functioning (Kulig, 2000), including the extension of community capacity. The model would also contribute to the meaningful identification of hazards, the recommendation of prevention, mitigation, preparedness, response and recovery and the development of local policies and procedures, among others.

1.8.4.2 Strategies to enhance trustworthiness of the study

Trustworthiness in triangulation begins with the adoption of a rich conceptual framework showing the various methodologies to be used. Gephart (1993) illustrated the potential of combining content analysis with other qualitative methods. Several other qualitative methodologies could potentially be applied in conjunction with content analysis for trustworthiness (Denzin and Lincoln, 1994a). Gephart (1993) proposed that content analysis can be used in conjunction with other methodologies for the purpose of triangulation, elaboration or integration (Doucet & Jehn, 1997). In this study, the conceptual framework guiding the study (Fig 1.1) provided some trustworthiness as a holistic template to guide data collection processes. Multi-methods and triangulation of the data were used to ensure trustworthiness.

1.9   Ethical aspects

The research proposal followed the expert and ethical approval process of the School of Nursing and the Faculty of Health Sciences at the University of the Free State. Participants of the local community (including the Chief) were informed of the purpose and approach of the study to supply them with information (Rongo, 2004: 55) and to obtain consent. The right to voluntary consent and participate was respected. Participants were invited to participate freely, ask questions and exercise their right to withdraw if they wished to do so. Respecting the time and place of appointments according to the needs of the community members was also taken into consideration also.

Confidentiality and privacy were protected by, for example, only using gender and age and by protecting participants' name or other identifying information. A numbering system to enhance anonymity was used to identify groups and participants. After completion of the research project, the researcher arranged for an opportunity to discuss the model as developed with the community to foster cooperation and action and to share ideas on how to refine a workable emergency plan.

The greatest ethical challenge is probably confidentiality (Neuman, 1997), because an institution or organisation may request that aspects within the local or international documents to be analysed are kept confidential. Careful consideration was necessary to

protect the sensitivity of particular documents. For instance, when hesitation was expressed, the researcher explained the confidential handling of all data to protect the source. However, documents were shared with the researcher openly after sharing the research proposal with the relevant person(s). In a few cases, the researcher was not allowed to copy or to take certain documents away from the organisation probably due to for fear of loosing such documents or for other reasons unknown to the researcher.

However, most government documents were provided to the researcher to take away and to return within an agreed period of time. The researcher photocopied and shared such documents with the assistant researcher for an independent assessment of content as agreed.

1.10   Value of the study

Planning for an emergency such as a volcanic eruption has often been treated with lethargy, since volcanic activity seems to be such an overwhelming phenomenon and provides limited signals before occurring, unlike earthquakes (Hawaiian Volcanic Observatory, 2006: 4). This lethargy results in population displacement, together with a collapse of social structure and breakdown of the health system, thus placing people at an even greater risk (Accorsi, Fabian, Nattabi, Corrado, Iriso & Ayella, 2005: 227). Furthermore, community viewpoints are often neglected when attempting to find meaningful solutions to address health issues of their concern. This study aimed to explore how a specific community views such a potential or real disaster and prepares itself for such an occurrence. The model that was developed incorporated cultural and social complexities, healthcare management practices and preventative strategies, integrating local, national and international perspectives. The model was developed in such a way that stakeholders and decision makers may reflect carefully on the way forward, further refining and applying the basic tenets of the model.

1.11   Outline of chapters

Chapter 1 provides a general introduction and background to the study. The problem statement, aims and objectives of the research are mentioned and the conceptual

framework and research methodology are described. Ethical concerns are discussed also in this chapter.

Chapter 2 provides an in-depth discussion of the research methodology. This includes the research design, unit of analysis (populations, inclusion criteria), research techniques (pilot study, data collection), data analysis process (data management, codes, decoding), measures to ensure trustworthiness, and ethical clearance.

In Chapter 3, the findings of the FGDs with three groups of community members (elders, men and women) and one health worker group (nurses) on cultural practices, health-seeking behaviours and acceptable emergency management approaches are discussed. This includes delineation of categories, sub-categories and themes, supported in the final instance with references to literature.

Chapter 4 provides documentary evidence, which includes exploring and comparing local, African and international strategies for the management of threats and emergencies related to volcanic activity. Analysis of related documents such as reports and policies are discussed

In Chapter 5, a literature review is provided of international literature reflecting on natural disasters, the management thereof in general, volcanic management and models in community health.

Chapter 6 reports the triangulation of the data from focus groups (community members and healthcare workers), evidence from documents and literature review (Chapters 3, 4 and 5) and a presentation of the suggested model.

Chapter 7 provides a summary of the findings, conclusions, limitations of the study and recommendations.

-End of Chapter 1-

CHAPTER TWO
RESEARCH METHODOLOGY

2.1   Introduction

An exploratory qualitative research design was used in this study. Qualitative data consist of information that is found in the world, which hold meaning for us or for others (Yates, 2004: 138). Exploratory qualitative research provides the opportunity to use a variety or range of methods to validate the data obtained and, thus, the rationale for multiple methods employed in this study. The combination of multiple methodologies, sources, perspectives and observers in a single study is best understood as a way to add rigor, breadth, complexity, richness and depth to research (Flick, 1998: 231). In this way, the data collection process can use interviewing, artefacts, documents, records, visual methods and focus groups (Denzin & Lincoln, 2004: 32). When multiple methods are used, triangulation strengthens and fortifies the results. Triangulation is a critical element in the practice of social science 'adding one layer of data to another to build a confirmatory edifice' (Flick, 1998: 187). The three qualitative research strategies used in this study consisted of focus group discussions, content analysis of documents and triangulation for the development of an adaptable model with a scientific community-oriented base. The researcher used an exploratory qualitative design that combines a number of qualitative research data collection strategies or techniques. These included focus group discussions, the review of a range of documents (content analysis) and triangulation of findings. These are all acknowledged data collection strategies utilised in qualitative research.

Qualitative research is comfortable inherently with multi-methods or strategies (Brewer and Hunter, 1989 in Fine, Weis, Weseen & Wong, 2004: 188). It claims to describe life-worlds 'from the inside out' from the perspective of relevant people and who will be or could be part of the solution. It seeks to contribute to a better understanding of social realities and to draw attention to processes, meaning, patterns and structural features. Qualitative research is therefore advantageous, since it creates an in-depth understanding and description of a particular aspect of an individual, a case history, or a group experience. Furthermore, it explores how individuals or group members give meaning to and express their understanding of themselves, their experiences and/or

their worlds. Qualitative research describes social events in detail and explores why they are happening, rather than how often. It investigates the complexity, ambiguity and processes taking place in a social context and provides a richer and more valid basis for social research than simply dealing with numbers and measures (Yates, 2004: 138).

2.2   Research design: exploratory research design

The specific qualitative design adopted was the exploratory research design, which incorporates the following qualities:

It focuses on a central issue or concern important to the study (Crewell, 2003; Yates, 2004).

It may involve the collection of both qualitative and quantitative data, implying the use of multiple methods (Brewer & Hunter in Fines *et al,* 2004).

It is used to formulate problems to guide more precise investigation and/or action, discover new insights, develop hypotheses, define priorities for further research, investigate suitable alternatives, increase understanding and clarify concepts (Creswell, 2003).

Uses multi-method strategies to collect data and to corroborate findings (ibid; Flick, 1998: 231).

The exploratory research design is generally considered to be rich and dynamic – providing a multi-faceted understanding for the phenomena at hand. It is considered advantageous to describe and define multi-faceted constructs, provide greater insight, and discover and explore (Kay, 1997). The design is able to deal with so-called 'softer' data – more traditional, emotive and spiritual – and is considered to be meaningful when issues are not clear, well-defined or unknown. The exploratory research design is helpful in obtaining a clear image of the context and perceptions, to search for alternatives (for example, of managing a given context) and to discover new ideas (Creswell, 2008).

The exploratory research design is considered to allow for increasing complexity, depth and richness in the data collected. It provides space to utilise a strategy or tool that is tailor-fit to the data required or the nature of the research question. Focus groups, interviews and document analysis are part of such strategies and are more easily able to fit the study context and population, in this case considered to be a developing country and community (Key, 1997). Exploratory research design is, however, at times considered to be fuzzy, complex and not precise. It may be seen as subjective and not easy or meaningful to generalise (Key, 1997: 4)., however, qualitative research describes a phenomenon not generalization.

The exploratory research design in this study incorporated three strategies for data collection. The rationale for the multi-strategy was to ensure trustworthiness, as the results from these strategies were triangulated to arrive at the model. Another reason for using a three-pronged strategy was to strengthen the explorative nature of the study due to being carried out in a developing country with limited infrastructure, systems and processes. The fact that it is the first time that a study of this nature was undertaken in the area also supported the choice of a multi-strategy exploration. The approach was found to be helpful in understanding the complexity of health behaviours and emergency management to be included in the model.

2.2.1   Focus group discussions

Focus groups discussion focuses on how the researcher constructs the social world with his/her respondents (Silverman, 2004: 5). A 'discussion' is initiated, namely a social action in which all parties reflect on their cultural knowledge and practices. The participants are usually introduced to a topic for discussion and the researcher facilitates the flow of conversation and always mindful of the aim of the study. Focus groups are said to create complicated interpretive activities between members of the group as they try to make sense of one another and of the researcher.

Explorative qualitative research data collection method is currently widely used, especially in research that focuses on or incorporates culture and belief patterns (Flick, Kardoff & Steineke, 2004: 193). The method in FGDs does not necessarily facilitate in-depth participation, but there is an opportunity to collect a range of inputs and provide for productive interactions (Bohnsack, 2004: 214). In such focused discussions, the

researcher conducts a discussion focused on an agreed scientifically valuable area of interest with a group of participants and such a focus or area relates to the aims of the study (Yates, 2004: 133).

Focus groups discussions are regarded by many as 'trendy' and are, therefore, at times judged in a negative manner (Gillies, 2003: 119). 'Although there are pitfalls, the kind of interaction between participants is the key to a successful focus group discussion' (ibid).

2.2.1.1 Strengths of focus group discussions

Focus groups discussions provide a meaningful interactive opportunity to collect and reflect on a range of inputs (Bohnsack, 2004:12). The group members or participants could be of a wide range or involve a cross section of a community, including both literate and illiterate participants. It is important that the subject matter is dealt with using a common language. Ambiguity is minimised, as the researcher may at any time clarify parts or excerpts of the discussion by asking probing or reflective questions such as '...you mean to say...' or '...can we talk about this some more...'.

2.2.1.2 Limitation of focus group discussions

The researcher needs to ensure that the process, amount and quality of data generated is well-managed, for example, remaining focused, carefully eliciting information and gently controlling, so as not to lose or miss any inputs. Very 'rich' data is often generated, thus making the task of data analysis quite complex and intense. Non-verbal behaviour is often critically part of the discussions as co-expressions of the spoken word, but these can be easily missed or misinterpreted. The elements of discussion and interactions can produce different responses (Gillies, 2002: 121), necessitating a carefully planned guide or template to be used, probably based on the objectives and/or conceptual framework of the study.

2.2.1.3 Focus groups discussion in this study

In this study, the conceptual framework fundamentally guided the focus group discussions. The discussions were carried out in Pidgin (a widely spoken language without a written component) of the community involved. The aim was to make the participants feel more comfortable and valued. It also encouraged the enhanced ease

and flow of discussions. In line with local customs, three groupings were used in the study, namely men, women and elders. A further rationale or benefit of the separate groups was that women may shy away from discussing freely in the presence of men and elders and men, too, may not discuss freely in the presence of elders. The use of a peer group helped to discuss cultural practices that may be considered sacred and not to be discussed. Fear was reduced and discussions could be more free or open over time.

2.2.2   Documents

As mentioned previously, documents used in research studies include public documents such as minutes and agendas of meetings, public policies and newspaper clippings. Private documents include journal entries, diaries, letter, and e-mail discussions (Creswell, 2003: 187). These documents provide insight and understanding regarding what has happened, what could be expected and the management of such events. The study and analysis of such data has been referred to as content analysis.

2.2.2.1 Advantages of content analysis

Content analysis enables a researcher to read the language and words of participants or writers (known or unknown, individual or collective) as of the time when the document was developed. The content can be used by the researcher at his/her own convenience and is considered an 'unobtrusive source of information'. The data is considered 'thoughtful, in that participants have given attention to compiling it. As written evidence, it saves the researcher the time and expense of transcribing' (Creswell, 2003: 187).

2.2.2.2 Limitations of content analysis

Human endeavours have been known to be limited by unforeseen circumstances. The limitations are often a result of constraints that may be difficult to overcome. In content analysis, Creswell (2003: 187) outlines a number of constraints. The information may be protected and thus not available to public scrutiny or may not be accessible. The sources may at times be hard to find or, when found, require transcribing or optical scanning. At times, the document may also not be authentic or accurate (Creswell, 2003: 187).

In this study, content analysis was performed on two types of written material published and unpublished-being used). These were local documents and literature of African and international origin. The content was analysed to determine the nature of hazards, cultural practices, management strategies, challenges and recommendations. To combat the inaccessibility to some local documents, the researcher provided the research proposal to individuals involved or stakeholders to encourage the release of such documents.

2.2.3   Triangulation

Well-designed qualitative research starts with a clearly formulated question that, at times, may require the use of more than one research method, integrated through triangulation eventually. The analysis must use well-defined, systematic and reproducible methods (Greehalgh & Taylor, 1997 in Gillies, 2004: 92). Triangulation is used to reflect on the research issue at hand from at least two different vantage points (Flick *et al,* 2004: 178). The different 'points' are often achieved by the application of different methodological approaches in the study. Qualitative research methods have used triangulation as a strategy for the validation of the procedures and results of social research. According to Flick (1998: 230), it is not a tool or a strategy of validity, but an alternative to validation. In the literature, four types of triangulation have been identified (O'Donoghue & Punch, 2003):

Triangulation of data combines data drawn from different sources and at different times, in different places or from different people.

Investigator triangulation is characterised by the use of different observers or interviewers, most often to balance out the perceived subjective influences of individuals.

Triangulation of theories relates to approaching data with multiple perspectives and hypotheses in mind. Various theoretical points of view could be placed side by side to assess their utility value and power.

Between methods triangulation is a combination of different methods and is most strongly associated with the concept of triangulation (Flick *et al,* 2004: 178-9). This was also the type of triangulation opted for in this study

2.2.3.1 Advantages of triangulation

As mentioned previously, triangulation has become a critical part of social sciences research, providing insight into a range of perceptions, understandings, policies and other directives. Triangulation is considered a meaningful and rich method of dealing with the outcome of complex but structured data collection processes (Polit & Beck, 2004: 432). It can bring together and confirm a range of findings, but can be used also to bring together diverse views on the phenomenon under study (Flick, 1998: 230; Cohen and Manion, 1986: 254). It aids meaningful reflection from more than one vantage point (Flick *et al,* 2004: 178) and is considered to cross examine and to add to confidence in findings. By combining multiple observers, theories, methods and empirical materials, a researcher may overcome intrinsic biases and problems common to many single-method, single-observer and single-theory studies. In this study two main actors were used who cross-matched data collected and more than one method of data collection was used.

2.2.3.2 Criticisms of triangulation

Triangulation has been accused of extreme eclecticism because, at times, too little attention is paid to the fact that every method constitutes in a special way the issue it seeks to investigate. Endeavouring to view and explore the phenomenon from a range of data sources may turn out to be more difficult because what occurs in one setting may not be the same somewhere else. A combination of different methods of data collection may also pay limited attention to the respective theoretical backgrounds and essences of the individual methods and may lead to more superficial outcomes or results. In light of the above, Flick *et al* (2004: 179) concludes that 'we should combine theories and methods carefully and purposefully with the intention of adding breadth or depth to our analysis, but not for the purpose of pursuing "objective" truth'. Triangulation as a strategy may lead to deeper understanding of the issue under study and is thus a meaningful way to pursue more or better knowledge. However, it does not automatically leads towards more valid and objective interpretation of findings (Denzin & Lincoln, 1994: 5).

In this study, information from various methods (FGDs, documents of local, African and international origin) were compared. Recurring themes in relation to the objectives of the study were identified. The management of volcanic health hazards was explored from a range data sources, merging these with local realities and actions to develop an

adaptable model for the Bakingili community in specific, and the other fouteen villages on the Mount Cameroon in general. The triangulation as seen on chapter five demonstrated the themes as they occurred.

2.3   Units of analysis

The units of analysis in the research represent the type of results found is the major entity that will be analysed in the study (Trochim, 2006:1-14). In this study, the units included the population that was used in all the focus group discussions (the sample, inclusion criteria, sample size and how the utterances of the final population were analysed). For the content analysis, the nature of the hazard, management, challenges and recommendations constituted another unit of analysis. Both units were triangulated to develop the model.

2.3.1   Population

Population in research address all potential elements (individuals and material) that provide the researcher an adequate opportunity to research the problem identified. Often, numbers are used to delineate such a population (Gorard, 2003). Usually the population should illustrate important or relevant features or processes in which the researcher is interested (Silverman, 2004: 102). In choosing the population, one needs to reflect critically on the parameters of the population and be certain that they meet the aim of the research (Mason, 2004a: 81).

 In this study, the Bakingili community members and health workers constituted the populations for the focus groups discussions, whilst the sample cases were selected using predetermined inclusion criteria.

As related to the content analysis, locally and internationally available and accessible documents/literature on eruptions, eruption hazards, management, cultural practices, health worker activities, challenges and recommendations constituted the focus for documents under examination, the contents of which provided the researcher with information to aid the process of developing an adaptable model. The research goal and objectives guided the selection of documents to include eruptions in particular and

disasters in general, as related to cultural practices, management, challenges and recommendations.

For the triangulation process, the unit of analysis was findings from the different FGDs (community members and health workers), local documents (e.g. policies and minutes) and international literature to confirm or refute the hazards associated with such disasters, the problem(s) or success(es) of the management approaches, the challenges, as well as the recommendations, to inform the adaptable model for the Bakingili community.

2.3.2   Sampling

The purpose of sampling is usually to study a representative subsection of a precisely defined population in order to make inferences about the total population (Payne & Payne, 2004: 38). Predetermined inclusion criteria need to be determined to reduce bias in the choice of sampling technique to be used (Mason, 2004b: 92). Many qualitative researchers employ purposive and not random sampling methods. They seek out groups, settings and individuals where the processes under study are most likely to occur or where the relevant characteristics or views are present (Denzin and Lincoln, 1994: 202).

With qualitative studies, the generalizability (though not always underlined in qualitative research) of results may be a sought-after but not easily reachable outcome. It may be achieved when the study group or sample truly represents the phenomenon being investigated (Merkens, 1997: 200). However, little value is often attached to determining a meaningful framework of a particular sample (Denzin and Lincoln, 1994: 200) as generalization is not considered necessary. Thus, it is not a question of representing the distribution of features in totality, but rather of determining what is typical of the phenomenon under investigation and thereby ensuring its transferability to other similar phenomena or situations (Hartley, 1994: 225).

In this study, purposive sampling was used to obtain a relatively homogenous group of community members, as the pilot study found that discussions among heterogeneous groups were under stress. Fear of talking was for example observed on the faces of women.   Meeting the various groups (elders, men and women) during their usual

Sunday afternoon meetings and then requesting volunteers who meet the inclusion criteria then made the groups homogenous for free flow of discussions.

As relating to the content analysis, documents were selected that focused on relevant issues within the study field, for example, the nature of a/the eruption, health hazards, management of such hazards and disasters, challenges, recommendations, successes and difficulties. Written material was collected, photocopied and shared with the assistant researcher. The purpose was to select documents that meet the aim of the study, and to analyse such documents. Where the same documents were listed as meaningful by the two researchers, they were included in the analysis. Internationally relevant literature, documents relating to natural hazards, successes and difficulties, as well as community viewpoints and mitigation practices, were reviewed. To ensure that the sampling was adequate, it was important to reflect on similarities and differences within and between categories, and to develop themes. This process continued till no new data came to the fore (Springer, 1998).

2.3.3   Sample size

In general, the validity of qualitative analysis usually depends more on the quality of analysis than on the size of the sample (Silverman, 2004: 42). Silverman (2004: 46) stated also that one case study could be sufficient in certain cases. At times, it is not easy to recruit a sample of the population that is prepared to deal with the researcher's questions about some phenomenon (Silverman, 2004: 95). Thus, participants may be a pre-existing group or may be brought together particularly for the research study. They can represent a particular population or simply share the studied characteristics or experiences. The norm for such a group size is between four and eight members (Wilkinson, 2004: 178-179).

In this study, groups of five and six participants were used for the focus group discussions. The group of elders consisted of six, the men and women groups each totalled five.

2.3.4   Inclusion criteria

The inclusion criteria for selection of participants of a focus group discussion include 'a pre-existing group, representatives of a particular population, or simply on a basis of shared responsibility and the norm of between four and eight participants' (Richards, 2005:90; Wilkinson, 2004: 180). This was the norm used in this study and thus individuals who had lived through at least one eruption (apart from other criteria mentioned) and who reported on the agreed time constituted participants of the study.

In reflecting on documents, only local documents that relate to the Mount Cameroon eruption phenomenon and internationally published articles of such natural hazards, mitigation practices, community viewpoints and activities during the hazard were used.

2.3.5   Sampling technique

Qualitative research follows a theoretical, rather than a statistical, logic approach in terms of sampling (Silverman, 2003:121). Theoretical here means that there is shared experience and, thus a percentage of the population may not be included. Individuals who have shared the experience in theory are being selected. The issue or the experience should however be couched in terms of the generalisability of cases/phenomena to theoretical propositions rather than to populations or universes (Mason, 2004b: 23-28, Bryman, 1987: 90). The sample was constructed theoretically and practically, as people who have lived through one experience, gave their consent voluntarily and indicated their willingness to attend the focus group discussion to avoid bias.

Mason (2004b: 38-39) mentions several advantages of theoretical sampling: The discussion is relevant to a particular phenomenon and the conceptual theory of the researcher; it has the ability to build on certain views, perceptions and assumptions of a group of people; the category of preferred participants can fit into the theory under study; it is well suited for exploring sensitive topics; and the group context may actually facilitate personal disclosures on the theory/phenomenon under study. The limitation of theoretical sampling is that it may be biased as the participants are already aware of the phenomenon. However, this limitation is controlled by the fact that the participants may find it interesting and meaningful to discuss such a lived experience.

2.4   Research methodology

The spectrum of qualitative research methods has expanded considerably in the past few decades due to various reasons. These include new debates on the theoretical status of qualitative research within the social sciences, differentiation of methodological procedures and inclusion of new types of data (Flick *et al,* 2004: 193). It was against this background that the three methods were used in the data collection and analysis processes, namely focus groups, content analysis of documents and data triangulation.

2.4.1   Focus group discussion

In the 1980s, health researchers pioneered the use of focus groups in social action research, particularly in the field of preventative health and education. These methods are still widely used in, for example, studies on family planning and HIV/AIDS, as well as in health-planning research (Wilkinson, 2004: 176; Carey, 1995: 5-4). The focus group is a way of collecting qualitative data and essentially involves engaging a small number of people in an informal group session for a discussion that is focused on a particular topic/phenomenon or set of issues. Discussions are usually led by carefully designed probing questions (the focus group 'question schedule'), and the researcher generally acts as moderator/facilitator for the group, posing the questions, keeping the discussion flowing and enabling group members to participate fully and safely (Wilkinson, 2004: 176). The moderator facilitates group discussions, actively encouraging group members to interact with one other (Tesch, 1990: 17). The interaction between research participants and the potential analytical use of the outcomes of such interaction have been described as the hallmark of focus group research (Weber, 1990: 26; Morgan, 1988: 12).

In conducting the focus group discussions, the researcher who acted as the facilitator, probed into the issues by asking"…do you mean…" such that group members were presented with particular stimulus verbal material as the facilitator was just relatively directive (Wilkinson, 2004: 179). The discussion was audio-taped and listening independently by principal investigator and assistant researcher.   The following additional advantages underlined the value of using focus groups in this study:
The focus group was found to be generally a faster and more efficient way to collect data from a group of research participants.

The approach is more naturalistic (i.e. closer to every-day conversation) and may include moments of storytelling, joking, arguing, boasting, teasing, persuasion, challenge and disagreement.

The solidarity among members who may know one another to an extent or share an experience seems to decrease their discomfort with the topic under discussion.

The homogeneity of the groups facilitated the flow of discussions.

The approach allows respondents to reach out to and to build on the responses of other group members, 'creating a synergistic effect' (Steward & Shamdasani, 1990: 16). Furthermore, deliberations may result in unexpected insight (Wilkinson, 2004: 181-182). The FGDs may also be used in a variety of ways and are often used in conjunction with other methods. Here it has been used with documents, mainly to add on data or contradict actions.

2.4.1.1 Exploratory pilot study

Exploratory pilot studies make 'forward' decisions about a study (Mason, 2004a: 44). The purpose may also be to try out sampling strategies, the possible successes of data generation opportunities and analytical techniques, or to allow the researcher to gain experience of some of the critical aspects of the research process (ibid: 46). The exploratory pilot study of this research guided the process and helped the researcher to assess all the developed guidelines, the efficiency and effectiveness of the recording methods, as well as the background, to provide training and preparation for research assistants. The Bokwoango community located forty kilometres from the study site and which was affected to some extent during the eruption was used for the pilot study.

2.4.1.2 Setting in qualitative research

The qualitative enquiry is generally fluid and flexible, and settings for exploring data in qualitative research is rarely restricted to just one (Richards, 2005: 19). Within this study, the setting was defined during planning with a clear rationale for the choice made (Ragin, 1994: 31). The Bakingili community experienced the 1999 and 2000 eruptions of Mount Cameroon and was the logical choice for inclusion in this study. Three venues were arranged in the actual study site. This was in collaboration with the community for the three FGDs of community members, and one for health workers (at the Batoke health centre). The elders FGDs were conducted in the chief's palace, men, in the

sitting room of a volunteer, and women, in open room used for storing crops to be transported to the market.

When entering a setting to do research, adequate preparation is needed; not only for the process and technique of observation, listening and communicating, but also for a range of other forms of being, doing and thinking. This set of activities performed in a research setting is often referred to as fieldwork (Mason, 2004a: 87). One faces a range of information, at times, lengthy stays and the presence or reality of complex and exhausting interactions and situations. The researcher's role may, at times, be less clear-cut and may be subject to frequent negotiations and renegotiations (Mason, 2004a: 87). The researcher in this study is a Cameroonian of a different tribe. Hence, negotiating with the local chiefs required the support and intervention of colleagues and other higher authorities. Fortunately, the result was effective cooperation of all involved. The consent of the local chief and the provincial delegate for Health was very helpful in entering the community and interacting with health workers.

2.4.2   Content analysis as a research method

There is a great scope for considering visual, sensory and documentary data when formulating research objectives. When reflecting on text-based documents, there are a number of different types:

Documents already in existence prior to the act of research, for example, acts of parliament, congressional papers, policies, statements, manuals and publications.

Other documents are generated for or through the research process, for example, diaries, written accounts, stories, biographies, pictures, drawings, charts and tables (Mason, 2004a: 87).

Content analysis is essentially a qualitative research method that includes careful immersion into the data and the development of categories, sub-categories and themes (Springer, 1998). Results need to remain true to the phenomenon studied. The concept 'data' describes the evidence and information obtained in the research context (Punch, 2004: 202). For data to be protected or safeguarded, it needs to be reduced carefully. During all the stages of data handling, the data should be preserved carefully, maning that elements that were not required are eliminated or deleted. (Punch, 2004: 203). In the early stages, data needs to be carefully edited and summarised, leading to the term

'data protection' (Knobloch, 2004: 361) and should involve those responsible for the handling and the protection of the data. In this study, a careful system of data analysis was used, inclusive of identifying categories, sub-categories and recurring themes. The quantitative repetition of such categories and themes was considered an important addition to the model.

2.5   Data analysis

The analysis, interpretation and presentation of data are often seen as the core activities of the researcher. The ability to transcribe data from tape-recordings verbatim to readable texts has made the analysis process more manageable (Flick *et al,* 2004: 193). Regarding the analysis of data, a number of developments have been made. For instance, reading and re-reading the data (data immersion), 'listening' to the data for emerging themes that may be coded, displaying the themes, questioning and verification and reducing the data to main themes have become critical activities. Although computer software packages are often used in coding types of analysis, multiple-approach research and discourse analysis may still not necessarily make use of such facilities (Silverman, 2004: vii).

Data analysis is directed at plotting stable and meaningful relationships between social phenomena (Silverman, 2004: v; Miles & Huberman, 1994: 4). Examples are identifying how themes relate to one another, explaining how study questions are being answered and the meaning that is produced. In an interactive model, Miles and Huberman (1994: 12); Gonard (2003: 24) placed the components of data analysis as a circle of activities that is each linked to one another. These include data collection, data display, conclusion (drawing and verification) and data reduction. In this study, the themes from the content analysis were compared to and traced back to FGDs themes. There was always cross-checking of themes with research assistant before comparing with data from other sources in the research.

Data reduction is continuous throughout analysis and is a part thereof but no loosing the meaning. Early in the analysis, it is achieved through editing, segmenting, and summarising data. Mid-way through, it is achieved through coding and memoing (notes), finding themes, clusters and patterns. At a later stage, data reduction occurs

through the conceptualisation and explanation of the phenomena at hand and, finally, in the development of complex abstract concepts (Gillies 2003:2).

The data in this study was summarised as the peoples' views/understanding of the mountain, views on the activities of the mountain and the emergency action taken during an eruption. Independent activities as discussed earlier were carried out with the same data, notes made and cross-checked. In this process, themes emerged and were presented as different parts of this research. They have been used to further explain the Mount Cameroon eruption phenomenon, its people, environment and activities around such volcanic eruptions.

2.5.1 Analysing focus group discussion data

Guidelines on focus group discussion analysis are often pointing to the content of the discussion (Silverman, 2004: 1-2). Most authors suggest or imply that the techniques suitable for analysing one-to-one-interview data are equally applicable for use in focus group data. Wilkinson (2004: 182) argues for the importance of theory-based evidence in analysing FGDs data. Therefore, scientists working with focus group data need to locate their method of choice within a clear theoretical framework. The choice of data analysis could then be, for example, content analysis or ethnographic analysis depending on the study design. Content analysis (content of the discussions) produces a relatively systematic and comprehensive summary or overview of the data set and incorporates a quantitative element at times (Richards, 2005: 34. Wilkinson, 2004:183).

2.5.2 Content analysis of documents

Documents, understood as written texts that serve as a recording of evidence related to an event or fact, occupy a prominent position in modern societies (Wolff, 2004: 284). A major part of the reality that is relevant to members of modern societies is accessible to them in the form of documents (Smith in Wolff, 2004). '[T]he increase in their significance is due to the secular trend towards the legalisation and organisation of all areas of life and in particular the development of the modern type of administration characterised by the principle of documentation' (ibid). The insistence on written documents that are typical of organisations as the preferred form for representation of reality cannot be over-looked. The formulation '*what is not in the records is not in the world*' was already a fundamental principle of the courts of the Inquisition, thus adding

an importance to the use of content analysis as a research method. Documents are standardised artefacts, in so far as they typically occur in particular formats such as notes, case reports, drafts, remarks, diaries and expert opinions.

2.5.3   Triangulation in data analysis

In the words of Kelle and Erbenzer (2004: 172-73), multiple methods of data collection could be used from different perspectives, thereby giving a more comprehensive and valid picture. It is not a tool or a strategy for validity, but sometimes an alternative to validation (Flick, 1998: 230). It adds rigor, breadth, complexity, richness and depth to an enquiry. In triangulation, various approaches to the integration of methods can be used:

the phase model, where qualitative methods are used to generate a hypothesis and quantitative methods for hypotheses testing; or

the triangulation metaphor, where different instruments of measurement or of different methods was used to enhance the validity of the results of an investigation towards reflecting reality and be trustworthy.

Often, the same social phenomenon is studied through the use of a range of methods, or it is used to treat different aspects of the same phenomenon or even different phenomena, the representation of which may add up to a unified picture. The same social phenomenon was investigated through different methods in this study.

2.6   Measures to ensure trustworthiness of results

According to Golafshani, (2003); Richards, (2003: 29); Roberts, (1997: iii), the use of reliability and validity are common in quantitative research and is now reconsidered in the qualitative research paradigm. This is often seen from the extent to which the results are consistent and whether transferability has been assured (Joppe, 2000; Krefting, 1991). Validity determines whether the research truly measures what it sets out to measure or describe. This could imply trustworthiness of results (Lincoln & Guba,2004: 74-75; Payne & Payne, 2004:63) when a vivid description of what the research set out to describe was achieved. This specific research study was aimed at informing policy and developing a model for community use within a specific social world. Thus, it required a very clear and true picture of community views and documented evidence of

such eruption hazards, specifically of Mount Cameroon, West Africa, to produce a usable (adaptable) model for the community and health workers.

2.6.1 Credibility (truth-value)

Golafshani, (2003); Richards, (2005: 112); Lincoln & Guba (2004: 271) view truth in research as the end product of rational processes, as the result of experiential sensing, and as an empirical observation, amongst others. To reach this end, the focus group discussions in this study were repeated and performed twice for each group (rational process), some field notes were made by the researcher and assistants (experiential sensing) and detailed observations were made before the onset, during and after the discussions, as well as during the serving of refreshments (empirical observation). All of these are required in attempting to describe a phenomenon (Rubin & Rubin, 1995:46)

2.6.2 Reliability and validity

Validity in qualitative research often involves transferability, dependability, credibility and conformability as elements of trustworthiness (Payne & Payne, 2004:37). Credibility essentially forms a basis for confidence in research findings (Hammersley, 1990: 156). Triangulation is believed to reinforce validity (Flick, Kardoff & Steineke, 2004:36). The combination of results from focus group discussions and documentary evidence also adds to so-called validity.

For **credibility,** the focus group discussions were repeated and continued for each group until no more ideas emerged. This was the same in all four FGDs, particularly during the second FGDs of the various community groups. There was consistency in the taking and follow-up of questions, with built-in probes to enable continuation, depth and clarification. During data analysis, it was found that the themes and frequencies were the same. Since credibility is how believable research results are usually as an understanding of the results from the participants' eyes (Trochim, 2006). Credibility was enhanced in this research by reaching consensus on the themes of the first FGD before the researcher proceeded with the FGD second the next day.

Transferability is the ability of research results to be generalized or transferred to another context or setting (Rodon & Sede, 2008; Trochim, 2006). It is often the responsibility of the one transferring or generalizing to ensure that the method that was used was adequate. Transferability in this study was enhanced by a clear description of the objectives of the study, its goals/aims and the methods used to collect and analyse the data. The research context was clearly defined thus ensuring that the content, data processes and results of this study could be applied to a similar context i.e another community affected by volcanic eruptions.

Dependability is the ability show reliability in qualitative research. It is the replication or repeatability of research, and it is achieved when the same results are obtained (Kuper, Lingard & Livinson, 2008; Trochim, 2006). In this study, the FGDs were repeated to confirm findings.

Conformability, relates to the degree in which results can be corroborated by others (Trochim, 2006; Golafshani, 2003). In this study, both the principal researchers and assistant researcher independently listened to the audio tapes, checked the transcription and translation and independently identified themes. These findings from this process were compared.

2.7   Ethical considerations

It is critical that the rights of subjects or participants are protected in research contexts (Yates, 2004: 159). Ethical and practical concerns relate to the exploration of quite personal or emotive aspects of peoples' lives. It is important to ensure that participants feel comfortable about speaking openly on the topic at hand. Participants need to feel that they can speak honestly or truthfully and express their opinion without feeling uncomfortable or exploited (ibid: 159-160). To ensure this, the following could be used: Employing some method to mask the identity of participants or make the contributions anonymous when reporting the results (dehumanising the data).
Involving the participants by allowing them to comment on the outputs of the research (drafts).

In the study, the participants were simply numbered so that the results did not indicate who made a particular claim (dehumanised data). During each round, participants were allowed to comment on the previous discussion before the new discussion commenced, thus allowing feedback from participants on their previous discussions and inputs.

The need to pre-determine what happens to the data after the research has been raised in a number of social science studies. The use of research information and the remains of data is important in all settings of care (Gillies, 2003:2). This implies that researchers must always ascertain what happens to data after completing the research.

All data collected was to be stored in a safe place, and the confidentiality of FGDs maintained by not storing any identifying data with the FGD transcripts. This data was to be kept till completion of the research report and the final feedback to the community members and policy makers re the model suggested.

2.7.1   Competence of researcher

The competence of the researcher is usually judged in terms of fulfilling the study objectives and whether the study adds meaning to social life. According to Yates (2004: 137), the subjective experiences of the researcher and the participants may be considered of less value than the central importance of adding meaning or understanding to social life.

The qualitative researcher achieves an in-depth understanding and detailed description of a particular aspect of an individual or of a group's knowledge, values and experience. Furthermore, qualitative research methods explore how individuals or group members give meaning to and express their understanding of themselves, their experiences and/or their worlds. It describes in detail social events and explores why they are happening, rather than how often, and provides a richer and more valid basis for social research than simply dealing with numbers and measurements. As the researcher needs to manage such sensitive situations (social events and why they are occurring) well, the importance of competence comes to the fore.

2.7.2 Competence of facilitator of focus groups

In general, the facilitator should not be a community member or at least not identified with any faction (Payne & Payne, 2004: 106). The researcher was suitable as the facilitator, being from a different clan and group, and being employed by an educational institution. The researcher operated the tape recorder and aided the flow of the discussions.

The facilitator of focus groups often requires specific skills and attributes to manage such groups. These include:

being informed and prepared;

utilising additional expertise for specialist information where needed;

using meaningful methods for probing and question construction;

managing additional problems from the group (e.g. concerns of the group that were not envisaged during planning) and group management activities such as ensuring that only one person speaks at a time;

ensuring that everyone is encouraged to speak in turn; and

ensuring that no one person dominates the discussion (Wilkinson,2004:134).

The researcher applied these skills in the focus group sessions. No person was allowed to dominate the discussion and all participants were encouraged to express their views on the issue being discussed at the particular point in time.

2.7.3 Permission and informed consent

Informed consent is an ethical principle that requires researchers to obtain the voluntary participation of subjects, after informing them of the possible risks and benefits (Greenbaun, 2006:51; Polit & Hungler, 1991: 643). Informed consent involves three key elements, namely 'that the potential informants should, as far as possible, be enabled to freely give their informed consent to participate and that they can terminate their involvement at any time. The participant's identity should be protected, and lastly that no harm must be done to the informant' (Denzin & Lincoln, 2004:64).

Permission for this study was provided by the Provincial Delegate of Health, the local chiefs and the participants themselves who were requested to freely give their informed consent after a full explanation. Confidentiality related to each participant's contribution to the discussions was clarified from the start. Informed consent also

requires that the person(s) involved should have the legal capacity to give consent, should be able to exercise free power of choice and should have sufficient knowledge and comprehension of the element of the subject matter involved so as to enable him/her to make an informed decision (Payne & Payne, 2004: 66-67). Individuals were all above the age of 18 years and were able to recall dates and activities related to at least one eruption, and could communicate these unambiguously. Participants were free to speak their mind, although following on the input of others within the discussion was a natural process that was closely observed.

2.7.4   Assurance of anonymity and confidentiality

Participants' identities should be protected by ensuring that their names and other identifying data are not divulged in any way. In this study, participants were assured also that any record of their actions or words will remain confidential and be viewed by the researchers only and not be reported to any other participant or individuals within or outside the research setting (Silverman, 2004:iv; Polit & Hungler, 1991: 644). The study provided the participants with an opportunity to listen to previously audio-recorded conversations. They could not clearly recognise or identify various voices and thus felt increasingly comfortable about participating in further discussions. No names were exposed to any authorities or any person outside of the research team, as numbers were used to depersonalise the data.

2.7.5   Quality of research

Scientists work daily with a relatively firm belief that most scientists behave honestly and hold the quality of their research study in high regard. 'They are not inventing data, lying about the success of their methods, suppressing findings or selectively reporting only those parts that supports their particular theoretical position' (Gorard, 2003: 2). In order not to omit data or use data selectively to support any specific theoretical position, the data analysis was scrupulously monitored and cross-checked, producing results that were found worthy of having fulfilled the objective of the study. The findings of the study could be useful to all within the vicinity of Mount Cameroon, as these people share similar cultures. The results could probably also be applied to other populations with similar community structures and vulnerabilities and who are exposed to similar natural hazards.

2.7.6 Conclusion

The research design and methods used in this study were found to be meaningful and appropriate. Focus group discussions related to key aspects of the phenomenon studied and the content analysis fit in with national and international observation and study trends. The results told a 'life story' of Mount Cameroon, its people and their activities, whilst the triangulation of data reinforced the results and aided the development of an adaptable model.

- End of Chapter 2-

CHAPTER THREE
FINDINGS: FOCUS GROUP DISCUSSIONS

3.1   Introduction

The results of the focus group discussions were meant to achieve Objectives 1 and 2. The focus group discussions were conducted with participants as a means of exploring, describing and, finally, drawing conclusions with regard to the understanding, cultural practices and values of community members and health workers (nurses and nurse aids) as related to Mount Cameroon's volcanic eruptions. During the analysis of the discussions, the researcher hoped to arrive at relevant concepts and finally reached some levels of abstraction that were primarily grounded in the inputs of participants. In less complex terms, the aim of this part of the research was to explore community members' views with regard to the way in which they see the mountain and its eruptions, their activities during an eruption, their views on the effectiveness of health care and other activities during eruptions and, where relevant, their views on resistance or cooperation. It is important that focus group discussions are capable of unveiling dimensions of understanding that might remain inaccessible by other data collection techniques (Burns & Grove, 2001: 545).

3.2   Realisation of sample

An introduction of the research and letter of authorisation to carry out such health-related research by the Provincial Delegate for Health (Appendix 6) was presented to the Chief of the community with a written request from the researcher seeking his authorisation to enter and work with the community (Appendix 7). After the Chief, in his capacity as the authority of the community, gave permission, arrangements were made to sound the 'gong' (a community member designated to make a loud announcement at dusk), inviting community members to attend the various meetings on the chosen Sunday. Members of the groups were selected from community members who responded to these calls for a community meeting on a specific Sunday afternoon. As is the usual practice, the gong was sounded again to remind community members of the meeting. As previously agreed with the community, those who responded first were

selected to participate in the FGDs. This was necessary as the ideal number of such a group should be between five and eight (Wilkinson,2004).

The purpose and approach of each discussion was explained to all those present. Informed consent was obtained from all participants, who were then asked to sign a consent form. As related to the focus group discussions with the Bakingili community members, a total of six discussions took place in a range of venues. Two sessions per group was held as community members also indicated that follow up discussions were necessary. The exploratory discussions with members of the pilot study indicated that the fear of expression among the participants could be handled by separating participants into groups of elders, men and women. A free flow of discussion was then facilitated by arranging women and men in separate groups at different venues and of meeting on different days. The use of an audio recorder was explained and actively demonstrated to the groups before its use.

Timing was considered a factor as it is often not respected by most people of the region. Thus, getting a sample from the identified persons who met the inclusion criterion of having lived through a volcanic eruption experience, were eighteen years and above and could communicate their understanding of the phenomenon under study was not difficult. The actual participants who participated in the study were the first five to eight individuals who arrived on time. Time, date and place were agreed with the participants to consider their personal activities. Elders for example, may be attending traditional meetings, the men may be hunting, or the women may be farming. A good flow of discussions in FGDs is often achieved when participants decide on the time of the event and have been found to be more relaxed (Payne & Payne, 2004:56-59). In the study, the inclusion criteria were also developed to suit the purpose. Mason (2004a: 134) stated that purposive sampling is meaningful to include participants who are equipped with knowledge of the issue under study.

The researcher assured the participants that their anonymity would be protected and that numbers, rather than individual names or other identity-related data, will be used. It is important to remember that all participants had witnessed at least one eruption, and that they all witnessed an eruption that was accompanied by an evacuation to rescue camps. The discussions were conducted in Pidgin and lasted approximately 45 minutes to an hour except for the health worker discussions that reached saturation in thirty minutes.

During the FGDs, probes were used where necessary to help participants to focus and explore the issues of concern and to continue until all information was exhausted. Examples of the probes were '…which of the chiefs…, you mean drink or apply… and what camps…. All participants were present during the follow up discussions on the next day.

Participants and the facilitator worked from an understanding of the objectives, and participants took turns in exploring or adding to the discussion. Responses were noted as saturation points (no themes emerging again) of themes were reached per FGD. The participants were numbered from elders through to women and men. In all discussions, the flow proceeded from views, to activities, effectiveness, resistance, cooperation and emergency behaviours (tables 3.1-3.6).

The discussion of the results of the three groups were, however, combined to further protect confidentiality and anonymity, and also served as a way of dealing with the relatively small size of each group. The researcher and researcher assistant clarified and verified data as received at the first discussion and their understanding thereof. The team thanked members, made another courtesy visit to the Chief and promised to return to share the documented experiences and to present the adaptable model to the chief and community as agreed.

The same process was applied for the five health workers during their discussions. Five health care workers voluntarily participated in a focus group discussion for health care workers. They were all nurses (mostly at the level of nurse's aids) who have been involved in at least one such eruption. The criteria and ethical rules were similar to those applied to the community members mentioned above. The focus group discussion

took place at their place of work and the time slot agreed upon was 13h:00 when work was minimal and just before closing time for the day.

The researcher used audio tape recordings as a basis to analyze and reflect on the content of the discussions. Two sets of the recordings were made so that each researcher could independently listen and cross-check content and meaning in context. The themes as identified by the researcher and assistant researcher showed meaningful consistency.

In reflecting on the analysis of documents, the researcher duplicated all documents that were thought to meet the objectives of the study and shared with the assistant researcher. The aim was firstly to agree on the relevance of the document, and secondly to identify the appearance of any themes. The set themes agreed to were volcanoes, active volcanoes, community perceptions and their views of such volcanoes, eruption history and the management of eruption hazards. During the cross-checking process specific local, African and international documents were found useful. The rest were discarded. The documents that were found to meet the inclusion criteria (or just part of the information above) were analysed by the researcher and research assistant separately – identifying the occurrences of categories and themes. The results are presented in Chapter Four. A limitation identified was the fact that documents of African origin described volcano activities but not much on the management of its hazards.

The outcomes of the three community FGDs and one health worker (nurses and nurse aids) FGD and the data from documents (local, African, and international) have been combined analytically in an attempt to produce a model that can be used by the Bakingili community in specific and other communities around the erupting mountains in general, thus accepting that triangulation enriches data and deductions made (Flick, Kardoff & Steineke, 2004: 78).

3.3 Preliminary categories and themes

A community located forty kilometres from the study site and which was affected, to some extent, by the said eruption of 1999-2000, was used for the exploratory (pretest) study. From the exploratory (pilot) study, categories emerged which were used as a basis to explore data obtained from the research community. These included views, actions, effectiveness, resistance and cooperation but did not constitute part of the results of this study. In the 'views' category, utterances from all groups were merged (table 3.1). The same was done for the 'doing', 'effectiveness', 'resistance', and, 'cooperation', categories. All categories and themes were supported by or illustrated by means of statements from participants.

In line with the qualitative research principle that all data is important, content analysis continued with the re-assessment, establishment and/or emerging of new preliminary categories and themes Gillies, 203:1. This enhanced clustering and counting that is considered important in qualitative research (Silverman, 2004: 136). The aim was to obtain an in-depth understanding of the participants' inputs, they way in which they used concrete activities, such as storytelling or providing colourful descriptions of a phenomenon (Flick, *et al*. 2004: 84. During discussions, an understanding of the mountain, its activities, cultural beliefs and values were probed. Probes such as "…who has a different view…''. Clarity was achieved by probes such as ' …do you mean…', until no new information emerged.

3.4 Findings

3.4.1 Community members

Community members tend to view the mountain as a god (*Epasa moto*) and believe that eruptions can be stopped by appeasing the gods: 'The god of the mountain is not always annoyed, but when he does, the mountain erupts… When the gods are annoyed, they cause the fire to flow from the mountain'. They also indicated that the cause of the eruption could be related to the death of a 'great one': 'The mountain erupted in 1982 when Dr X, the politician died… In 1999-2000, chief Y of Great Y died before the mountain started erupting'.

'When the appeasement is accepted, the god of the mountain, *Epasa moto*, stops the eruption'. They also stated that if men go close to the cone or perform some other meaningful appeasing activity, this stops the mountain from erupting: 'We actually saw the paramount chief, Chief Z when he arrived and took some elders and our local chief into the forest for the appeasement… the next day the lava stopped flowing'.

Some members also mentioned albinos constituting one such an appeasing offer – a belief apparently held by the elderly:

> …the older people hold the idea that it is the lost of a great ruler that causes an eruption to occur and this is why they use to sacrifice a *mukala* (local appellation for albino) at the eruption site. This was intended to stop the eruption… when the lava flow was already approaching the village, some elders followed him into the forest, where the sacrifice was performed… a few days after the sacrifice the lava crossed the main road and just stopped without entering into the sea… certain things are used to appease the gods… hhhm… aaaahm… Albinos are used…

Participants were also concerned that such an eruption destroys sacred places and that the guarding of tombs is a concern:

> The mountain is part of us. When it erupts we are bound to stay because we have been with it, we have buried our beloved ones here, and so we must stay here to watch over the tomb stones. Whenever the danger is very severe we can afford to leave the mountain for a while and return to the tombstones when the mountain becomes peaceful again.

Their knowledge of the eruptions, for example, the start of tremors ('the eruption begins with tremors which we feel, before government comes in to inform us of the extent of the eruption') and reaction to such tremors was worth noting: 'The feeling of tremor is a common phenomenon. If you ask people to be evacuated because there is a tremor, just know that nobody will move'. Participants also displayed their knowledge of the harmful effects on health: 'There is always water pollution and we suffer from eye and skin irritation'. Other harmful effects include 'when this is happening our farm lands

are destroyed and we suffer economic loss and even starvation as all the cocoyam and other food stuff are destroyed'.

The educational inputs of media, scientists and the government concerning such eruptions and its impact, for example, water pollution, have been viewed as positive by the community members: 'We are often informed by government which we see as strengthening us... They (government) quite often will inform us (by radio) on the happenings which we in turn tell others in the village'.

The monitoring of mountain activities and the scientific monitoring apparatus at the local university was appreciated, but they were not sure if and how the local community could benefit from such apparatus: 'We are aware of the monitoring apparatus at the University of Buea, but we are never informed of its functioning, we are only hoping that it is working to help us out…'. Difficulties mentioned included a delay in information and the initial confusion that is part of such a natural disaster.

If one reflects on the way in which community members manage such an eruption, it is clear that they consider the local chief to be the fastest means of communication and conveying information. They also considered the use of the communication gong of the village as an excellent way of communicating important news: 'The most important cooperation that we have is our traditional announcement system – the gong. When we sound it (somebody goes around the village announcing) everybody comes out to get a message'.

The local council was considered an important body with an important role to play, but was also marred by limitations:

> The (local) council is here and we think that they should also be able to help us fast before waiting for government and other bodies… the council is, however, not rich but we expect some assistance even in the form of food when we cannot go out to look for food.

Women are excluded from the Traditional Council and thus find it hard to convey their ideas and suggestions.

The three different groups mentioned a range of actions, including elders of the community staying in the village to keep the guard, men going out to the mountain, while some 'run away' from the lava flow, and so forth. Palm oil is usually applied to the nostrils or even ingested: 'The women have a responsibility of staying at home, applying palm oil on children's nostrils and even giving them some of the oil to drink, while the men watch over the village for any forms of hazards'.

Some members were concerned about the influence of cultural beliefs and practices during times of eruption. Preferred actions include constant alertness, rushing out of homes, preventing the inhalation of dust/ash particles (especially where children are concerned):

> Ah—when tremors begin, the first thing we do is to open our ears to any community actions to be followed. All our feelings, mind and thought are focused on what could be happening, and then we listen to any form of safety instructions… some of us still need to put in our heads that the eruptions could be very risky, we would need the authorities to constantly remind us with information.

In reflecting on management practices, fear of the evacuation option was apparent: 'Evacuation is one of the things we accept to do, but this is done with a lot of difficulty, as a matter of fact, I will rather die here or go to a nearby village rather than the camps. The women can go'. Another participant stated categorically that 'the idea of just dragging us out of the village when the relief arrives is very difficult for us. We are not children, we have said earlier that we have some attachments here, we will prefer assistance here'.

Resettlement of the entire community was not considered to be an option due to the fact that their ancestors lived there and because the rich soil surrounding the mountain has excellent farming potential:

> We cannot leave this village for any other community. Whenever government talks of resettlement it disturbs us, it makes us to stop thinking because this is our village; we were born here, we cannot settle somewhere else.

Speedy transportation to evacuation camps was considered to be important, as well as the upgrading of the facilities in evacuation camps. They were particularly concerned about safety and security in the camps, as well as that of their property and belongings at home. It was referred to as the:

> … difficulty that this village faced when the mountain erupted in 1999 was that while away in the camps, thieves stole our property. We see that as a hindrance to progress, because you cannot see someone who is dying and you kill him further… we were also expecting aid from people out of Cameroon who might hear of our critical problems and wish to help, particularly to assist us to stay well in the evacuation camps.

National aid from government and donors, as well as high quality health care was considered important: 'Our health centre is empty, no staff, and no equipment to work with, so much so that we are still depending on the health centre for most services, even some wound care'. They considered schools for the education of the youth important and indicated appreciation for information sessions (meetings) held pre- and post-eruption. They wished for the provision of protective 'devices', the provision of pipe-borne water and good monitoring of the mountain's geo-dynamism: 'We would not very much wish to move out of our community. We would very much love that protective devices are given to us to protect us from the dust'. Participants also appreciated the influence of tourism when such a natural disaster area becomes known: 'When we work in harmony with tourists, researchers and foreigners, we believe that we are cooperating because without which, it will be difficult for them to really see or know anything'.

The identification of missing community members, if any, was also considered to be an important concern. Another interesting input related to the need of finding ways of preventing the annoyance of the gods. Other religions were considered by some to be an interfering factor with regard to achieving this critical balance:

> Ever since the eruption occurred, we have had a problem with influx of churches. Worse is that they are derailing the course of discussion on how we

can control eruption by preaching that eruption is a result of sin committed against God.

According to some of the participants, resistance to help is usually found firstly in the Traditional Council, followed by men and lastly women. Forms of resistance include open confrontation with government officials, maintaining a firm position not to move and not allowing 'visitors' into the community before or at such troubled times. No feedback from such visitors seems to have been a problem, but a number of participants did indicate a willingness to cooperate with tourist and other so-called 'foreign bodies'. The realities in terms of conflict between cultural versus scientific views were apparent and continuous education was offered as a way of addressing such opposing stances. In reflecting on the 'chosen' or ideal emergency action, participants mentioned adequate surveillance, the ability to 'move alone', togetherness in actions and heeding advice provided with available means. The support of government was considered crucial: 'When anything happens we are only forced to be observing while waiting for government as there is just no system or structure to inform us or help us'.

In conclusion, participants were clear with regard to being involved in planning activities that affected them directly and indirectly, and reflected on the negative outcomes of not being involved:

> When you plan without us, nobody tells you the areas that our customs will not agree with. If you work with us during planning we can say that: change A to B or otherwise… It is good that when you people have finished and gone, you should come for us to sit together and see the things all over. Not wait until another eruption before you come again.

3.4.2 Health workers

Health workers understood the eruption as being chemical, and an 'edifice of magma': 'I see the mountain as a chemical cone whose contents were pouring out during the 1999-2000 eruption…'; 'it has never crossed my mind what it could be made up of until we saw what was called lava…'; 'this is an edifice of magma because what we saw moving down like a moving mountain was amazing…'; and 'in geography, we learnt

that when chemicals underneath the earth force their way up and explode it is like magma…'.

They acknowledged the fertile soil surrounding the mountain for farming purposes and as a tourist site, but were concerned about the health risks to the community, albeit honestly stated for personal staying power: 'With the low salaries, the mountain is a source of hope as its fertile soils subsidies my income'; and 'the mountain attracts tourists and we are sometimes opportuned to be exposed to some fruitful ideas and experiences…'

They also acknowledged the value of using constant effective communication with all those they meet, especially after experiencing the previous outburst: 'The healthiest behaviour we put on around here is telling the community the risks of the mountain as we saw in 1999-2000' and 'before then we only used to hear that it could be very dangerous until we came in contact with the natural disaster'. Communication with the local chief was also considered of paramount importance: 'In this community there is belief in what the Chief says, so if there is anything like vaccinations that they are not willing to take we go through the Chief and they are convinced to take'.

Before or during an eruption, health care workers requested relief teams, urgent supplies and intense health education on the risks imbedded in such a disaster: 'Listening and discussing with any scientist or relief team is one of the things that we always do because we are not experts in geology or geography or environmental scientists'. The critical matter of equipment and relief staff was well considered: 'The problem we have is lack of basic equipment. So much so, that we, first of all, will start requesting for a relief team and supplies'. The difficulties are imbedded in waiting for government supplies and the ability to provide meaningful first aid and care: 'Having to wait on government is difficult because the minimal things like face masks are not even available here since the eruptions take long to occur'.

On the other hand, some participants felt that health care support was effective in the 1999-2000 occurrence: 'The way medical aid arrived was very effective because the doctors and nurses arrived when the lava flow just began'. Some also praised the regional council:

The council brought water and trucks that were used together with other vehicles to transport people to the camp in Tiko… They provided the place where the people were transferred to and other government people provided others. We however only heard because we did not visit them there.

They believe communication with all sectors involved is of critical importance, as well as the need for a community to stand together and mutual respect for one another. 'Yes, for instance, the fact that the majority of the community listens to us particularly in the face of an emergency and are always using combined efforts with the council workers, us the government as a whole is good for any emergency strategies…'

The protection of water resources ('they even know that their water sources could be contaminated and work hard to try to protect them by covering with some new iron sheets'), relief medical aid and logistical support were also mentioned. This included well-organised evacuation facilities. The linking of the site to media resources and aid agencies was also believed to be beneficial in the longer term.

Health workers considered the firmness or attachment to cultural beliefs to be an obstacle that hinders the implementation of health actions in reducing and managing risks: 'We actually did not meet with any resistance except when some beliefs like the cause of the eruption could not be changed from annoyance of the gods to the scientific explanation'.

Some participants experienced limitations in terms of cooperation at referral areas: 'There were moments when colleagues at the V District Hospital (the first referral point) would not want to recognise us when we tried to find out the availability of services'. Logistical support and the management of donations came under scrutiny: 'Even when donations came we were not allowed in taking part in directing to the most in need since we know them better. Everybody evacuated was treated the same'.

They believed that joint decisions and actions in emergency situations were important: 'Emergency situations are periods when a health worker cannot afford to be away except due severe illness' and '[w]e were all present at all times…'. Health care workers believed that the community should partner in developing a well-established

plan and action: 'Anything that was discussed, particularly safety measures, was in collaboration with the community to avoid or minimise resistance'. Health care workers expressed the fact that their personal commitment also benefited from such cooperation: 'One very important thing was that our opinion was considered in everything especially in what was acceptable by the community. This made us very willing and committed to work'.

3.5   Quantification of focus group discussions

Although quantification is not always employed in qualitative research, it does aid the making of judgments, strengthening of arguments and enhances reflection on narratives (Burns and Grove, 2001: 602). The following tables illustrate a number of such frequencies attached to statements made during the focus group discussions.

3.5.1   Community members focus groups

The tables below indicate that the view of the mountain as a chariot of the gods that needs to be appeased, the actions of the establishment of a well-equipped health care centre and the use of coconut oil, as well as giving credit to adequate monitoring of the mountain, stands out.

Table 3.1: **Responses related to views/perceptions of the mountain – six focus group discussions, (f) of response = >5**

Themes	Frequency
Mountain seen as chariot of the gods	13
Can stop eruption by appeasing the gods	11
Annoyance of the god causes eruption	10
Epasa moto (god) stops the eruptions	8
Elders must remain behind to keep guard	8
Death of a great one causes eruption	7
Eruption begins with tremors	6
Eruption pollutes the air and water	6
Looting of property while away in camps	6
Monitoring of geo-dynamism of mountain important	6
Conscientiousness with regard to eruptions and hazards	5
Eruption destroys sacred shrines	5

Table 3.2: **Responses related to doing/actions when the mountain erupts – six focus group discussions, (f) of response = >5**

Themes	Frequency
Need to adequately equip health centre	19
Application of palm oil to nostrils/drink palm oil	12
Appeasing the gods to stop eruption, including men going to mountain and sacrificing of Albinos	6+4+2
Monitoring and education on eruption risks, managing contradictions between scientific and cultural practices	9
Run away from lava flow	6
Evacuation camps (but not considered satisfactory)	5

Table 3.3:   **Responses related to effectiveness of actions when the mountain erupts – six focus group discussions, (f) of response = >5**

Themes	Frequency
Value the monitoring of mountain activity	8
Consider resources not available during an emergency	7
Identification of victims is important	6
Seeking ways to prevent the annoyance of the gods is important	12
Use of any available information/resources	5

Table 3.4:   **Responses related to resistance – six focus group discussions, (f) of response = >5**

Themes	Frequency
Importance of maintaining the original settlement	14
Resistance rife when tremors begin	13
Importance of maintaining a firm stand	11
Men in general, and members of Traditional Council resist contemporary response(s)	9

Table 3.5:   **Responses related to cooperation – six focus group discussions, (f) of response = >5**

Themes	Frequency
Community communication strategies important	13
Executing of such strategies	13
Collaboration with tourists and foreign aid	5

Table 3.6: Responses related to emergency behaviours – six focus group discussions, (f) of response = >5

Themes	Frequency
Being alert and listening; adequate surveillance	15
Staying together	10
Preventing inhalation of dust	9
Rushing out of homes	8
Protecting children's nostrils	8
Women to stay at home	8
Taking advice with available means	8
Initial confusion	6
Evacuation as last option	6

3.5.2 Health workers focus groups

Five health workers considered the mountain to have fertile soil suitable for farming, but also pointed out the clear imbedded risks to the community. Eight or more responses reflected the important need for first-aid health education as an important health care action, while more than five responses identified alertness and relief medical aid as highly effective strategies. Discussions on resistance mostly centred on the firmness of cultural beliefs and the limited belief in the value of health actions in making a difference. Emergency reactions that were mentioned five times or more included staying together, preventing inhalations, staying clear of risky sites and collaborative involvement in relief actions.

3.6 Concluding remarks

Qualitative researchers are required to direct efforts towards the presenting of arguments, the construction of perspective(s), interpretation(s), or a line of reasoning. It is a relative process (Mason, 2004a: 173) and such analysis provides structure and meaning to the data gathered, reflected on and presented.

3.6.1 Reflecting on the input of community members

From the conceptual framework, the views held of such a potential natural disaster by the community could strengthen or weaken the management of such an emergency. An emergency such as an eruption requires community efforts, both collectively and individually. Thus, knowledge of the cause, its events and impacts would or should create views that can strengthen or weaken a community in its effort to deal with such potential disasters. Knowledge and understanding of the event is capable of preventing consequences (Rahman, Shafinaz, Linnan and Rahman, 2008:176-180). Participants in the groups expressed definite views in terms of the mountain and its eruptions. These views were regarded as strengths since their beliefs had not failed them.

Mogensen (2005) asserts that community perceptions are invariably related to the phenomena around them and has a direct link with any activity or practices. In an attempt to develop a model that is adaptable to a particular community, it is essential to consider what has been considered to be strengths in order to provide the necessary impetus for appropriateness and usability. A community will mobilise its efforts when the event or activity does not interfere with its belief systems, but instead is found to be educational, particularly as in terms of chronic problems (Mellon, Gold, Janise, Cichon, Tainsky, Simon and Korczak, 2008:276-278). The presence and utilisation of media (especially the radio in this area) provided valuable information and education. It empowered community members to inform one another concerning the realities and effects of previous impacts, for example, water pollution, and skin and eye irritations. Windsor, Anstey and Walker (2008) indicated that media coverage relates directly to understanding and most often to risks reduction. Afane *et al* (2001: 30-36) consulted between 30 and 50 patients during the eruptions in 1999-2000 for skin and eye irritations.

One community belief that was considered to be a point of strength by its community members may not be perceived by health care workers as such. This related to the belief that the eruption stopped when the gods were appeased. The findings from the Bakingili community again emphasised the importance of understanding the perceptions of the community with regard to such matters. Health-seeking behaviours are affected profoundly by such beliefs, and is in line with the findings of Postestio, McLaren, Robinson, Vollman and Doyle-Baker (2008: 86-90) who indicate that views held by the public in such conditions invariably affect health-seeking behaviours. However, many

of the health impacts were relatively well understood. The community was seemingly well informed of a number of health risks. This knowledge did, however, appear to be in opposition with the actual cultural practices of some groups. This requires rigorous research regarding cultural, social, economic and environmental factors, which, according to Intaliata, Ip, Gesell and Barkin (2008: 88-91) may lead to inaccurate perceptions of problems and solutions.

A number of participants saw the activities or happenings of the mountain as emanating from the annoyance of the gods. Destruction without a good cause could be viewed as injustice which may lead to a lower perception of the self or group, as well as to the questioning of godly interventions. The apparent discomfort related to being able to understand the mechanisms involved, thus indicating that cultural belief patterns may exert pressure on some of the affected citizens. Pressure has been observed as a barrier to healthy eating or other healthy behaviours (Welch, McNaughton, Hunter, Hume and Crawford, 2008: 1-8). The health worker can utilise such realities for future health planning within a community.

Some participants were also concerned with the fact that cultural factors, such as keeping watch over the tombstones of deceased loved ones, were difficult to adhere to. At times, an individual or a whole community could be concerned about a matter at hand, while choosing to maintain an unhealthy stand. Rahan *et al* (2008: 176-80) found, for example, that participants knew the causes of childhood drowning and its preventive measures, but refused to put their knowledge into preventative practice. A successful model in this regard would have to include not only educational strategies, but role-modelling – especially of important members and health care providers of such a community.

Participants were clearly not in favour of resettlement options, thus requiring an innovative model that is clearly monitored and evaluated 'for satisfying its inhabitants'. Community coordination in terms of the incorporation of local government leaders may be critical. Russel *et al* (2008: 644-651), in exploring community perceptions of community problems, discovered a low level of coordination and the non-use of local government leaders as sources of poor problem-solving ventures. It is evident from the literature that there must be collaboration between the health sector and community

coordination and other bodies, such as local councils (government). Within Cameroon, a number of sectors would be involved, for example, the ministries of housing, town planning, municipal councils, social welfare services, ministries of education and territorial administration (Ayanji, 2004:4). The success stories surrounding changing beliefs and attitudes lie within the provision of basic acceptable services. National governments must not forget their responsibilities, especially in defining and ensuring basic services that must be accessible to all (Richards, 2005).

Experiences from the Bakingili community in the South-West Province of Cameroon indicates that emergency actions are critical when Mount Cameroon erupts and that information is required on the procedures to be followed. Fortunately, the National Health Strategic Plan, (2001: 123-25) addresses equity in the distribution of resources, ensuring risk reduction and the establishment of transparent disaster management plans. In line with the views of Palumbo, Rambur, McIntosh and Naud (2008: 8-14), it notes that such plans must be multi-disciplinary, particularly in stating that health care is increasingly dependent on highly collaborative multi-disciplinary teams.

The persistent inefficiency of the public sector in many developing contexts is of concern. In the same way, the issue of expecting fast aid from the local council, national aid, aid from donors and international bodies require that messages be given to the population as to what should be expected, and when it is available – there should be some explanation on the source, as well as the defined utilisation or purpose of aid obtained. Communication has been identified as critical to the effectiveness of any programme (Brooker, Marriot, Hall, Adjei, Allan, Majer, Bundy, Drake, Coombes, Azene, Lansdown, Wen and Dzodozmenyo, 2001: 1075-1083).

A critical incident is any external event that alters an individual's or community's life from the perspective of that individual or community (Patrucka and Wagner 2003: 249-253). In such situations, the population expects items or commodities and services that they are unwilling to pay for unlike the willingness to pay for drugs exemplified in studies of non-disaster threats (Ulukanligil, 2006: 1063-1068). From this study, it is clear that the donations thought of related mostly to food and proper shelter, and a number of participants indicated the need for protective devices. The devices were further described to include face masks, good drinking water, and mobility facilities (e.g. an ambulance service).

It is often good to alert the population to health hazards related to natural disasters, and more specifically Mount Cameroon eruption hazards. Afane *et al* (2000: 30) registered a good number of consultations at the Batoke Health Centre, 6 km away from Bakingili, stating the rationale for providing nose masks when the mountain erupts. Although the dreaded lava flowed towards the eastern slope in 2000, and had stopped temporarily at the end of June, other volcanic manifestations, such as earthquakes and volcanic explosions have indeed continued to remind the inhabitants that they continue to live and work in a high-risk zone (Lambi, Kometa, Fogwe and Apiapuh, 2001:31).

Usually, a person expresses a wish in the hope that someone will either further convey this need or address it directly. Postestio *et al* (2008: 86-90), in their study on childhood obesity, used views and wishes as guidance in developing publicly acceptable intervention strategies to be used by health promotion researchers and policy makers. Community members expressed approximately six wishes, ranging from well-equipped health service centres, better facilities during times of evacuation (camps), fast deployment of health teams whenever disaster was eminent, the monitoring of geo-dynamism, provision of pipe-borne water and the creation of better awareness. The participants spoke in a way that could be perceived as a message to the authorities, politely requesting better services for all those concerned. These requests may highlight the need for or an extension of a special commission on disaster, which is currently in place in Cameroon. When a disaster of such proportions occurred in Ethiopia, the Ethiopian Government's Disaster Prevention and Preparedness Commission arrived almost immediately and provided services through the use of a multi-disciplinary team (Palumbo *et al*, 2008).

Hindrances are a common phenomenon in limiting progress, and such an eruption may prevent the community from carrying out activities that are a source of livelihood and survival. Lambi *et al* (2001) states that the repeated ecologic occurrences of the Buea vicinity now constitute the most common environmental hazards in the area. Such hazards may require resettlement options, which the participants perceived as a hindrance. On the other hand, their inability to control such hazards themselves also led to frustration and fear. Instances of, for example, running away from the lava were repeatedly mentioned, as were those of women staying at home for protection, as well as of holding meetings in the Chief's palace to reflect on progress and government interventions. Wurbach (2002: 76) supports the premise that governments develop programmes for its people while, at times, communities develop their 'own programmes' through their own agencies. For example, women have been considered to be weaker and thus of requiring more protection. They are seen as home 'carers' who should not be exposed to the trauma of eruptions.

Some of the participants indicated some concern regarding activities they were engaged in during an eruption. Examples include fear regarding the safety of elders as they move too close to the erupting cones, the realities of refusing evacuation and the practice of forcing elders to remain in a village to care for property. The dangers of eruption are known to include a threat to communication, disabling health effects from ash fall, destruction of farmlands and drinking water sources (Paton *et al,* 1997:2), requiring good communication processes, community development, emergency planning and response management. The United Nations Secretary of State claimed that 'disaster reduction is about stronger building codes, sound land use planning, better early warning systems, environmental management and evacuation plans, and above all education' (Wednesday, 10 October 2007).

The strengths of any community need to be fostered by government action. What is seen could change perspectives and provide the force with which to act. Responses to the needs of local inhabitants and the combined responses of inhabitants could prove to be very helpful – 'no volcanic system can be helpful without the collaboration of local populations, before and during the eruptions' (SVE, article 1, http//www.sverop.org/gb/articles, 1999). Participants, in general, believed in the monitoring of the mountain activity, of eliciting government support to minimise risks, and of looking out for one another: 'At that time we are each other's keeper'.

The need for a good community health care centre cannot be overlooked. The outreach of health care delivery by the network of primary health centres to cater for the needs of the community has been assessed by the communities themselves (Babu, Chhotray, Hazra and Satyanarayana, 2001: 1-13). Thus, for a community to wish for an equipped health care centre is an indication of understanding with regard to their available or potential risk and should be applauded.

Resistance has been described as a refusal to act, or participate in matters of concern. When an individual or a group of people resist, the manifestation of the resistance is observable. Resistance can take the form of simply standing firm on one's point of view, refusing to listen to anyone, chasing the so-called reformer out of sight, running away and/or hiding, and open confrontation with the stranger or reformer. When a programme, an event or an issue is appreciated, resistance disappears and willingness to abide emerges (Ulukanligil, 2006: 1067). It was interesting to reflect on the refusal to leave the village within the discussion groups, and it became clear that three members of the Traditional Council, six men and one woman resisted evacuation. An interesting question posed by one participant was: 'Are we being evacuated to where the mountain eruption will not reach when it wants to?' Participants in all the groups agreed that there was some form of resistance during the 1999-2000 Mount Cameroon eruptions, linked to understanding of problems, cultural practices and/or values. Timing of evacuation efforts also seemed to be controversial, with some participants indicating a resistance to evacuation only when tremors are felt.

The belief of some participants that the eruptions occur only in one direction and only after a significant number of years was disproved during the 1999-2000 eruption.

During this time, the eastern slope of the mountain was also involved and it erupted barely thirteen months after the previous eruption (Lambi, 2001: 60). A large number of participants (fourteen) were of the opinion that resistance to evacuation was simply related to the fact that Bakingili is their original area of settlement.

In research on human subjects, cooperation between the researcher and total population under study usually yields good research results (Yates, 2004). Also, survival in any community requires community involvement and participation. Participants in this study saw that cooperation could be beneficial, but that there were also difficulties to be encountered in trying to cooperate with reformers, researchers and government officials who claim to have come with the intention of helping. From the focus group interviews, some participants saw cooperation as related to collaboration with tourists, researchers and foreign bodies who visit the community. Disaster-prone zones may sometimes produce features that attract tourism and community attitudes towards tourism cannot be over-emphasised (Pearce, Moscardo and Ross, 1991: 147-153). Today, Bakingili remains a tourist site requiring adequate cooperation from its members. It is not uncommon to find a group of people or a community wishing to cooperate with any good interventions, but it is difficult when ideas and perceptions create conflicts:

> We want to work with scientists, but when they cannot believe that the gods can also stop the eruption, it becomes difficult for us. Deep down in us we know that science knows much on eruptions, but at the same time they should know that when we ask them not to go nearer the shrines they should understand.

Community participation and involvement at every stage in the development of strategies to resolve community problems have been found to be very beneficial. For a strategy to be recognised as aiding, accepted as useful, and maintained, it should be appropriate enough to meet rural/community needs and requirements – especially if the experience has been lived through before. Siegrist and Gutscher's (2008) survey on natural hazards and motivation for mitigation behaviour observed, amongst others, that personal flood experience was an important factor in motivating mitigation behaviour. The participants in the focus group interviews saw cooperation in every activity, strategy and decision as a positive force. They were not really interested in a list of strategies, but rather in the processes involved in arriving at conclusive decisions. This

included planning, execution and monitoring of effect. Thirteen participants wished for cooperation in executing any strategy meant to help the community. Three others were of the opinion that during planning, they should be involved in order to be made aware and to guide the process in avoiding conflict with their customs. One other participant thought that it was good for a team to return to them for an overview of the successes and/or failures.

Community participation and involvement is the cornerstone of all community projects, programmes and services. In assessing the way in which the features of disasters influence risk perception, Ho, Shaw, Lin and Chiu (2008) identified community participation and involvement to be relatively easily achieved when victims and the general public are concerned about the different potential hazards that might affect their residential areas and services. Emergency behaviours are related to actions that an individual or group of people will engage in when there is a hazard or perceived risk to life and/or property. Such emergency actions may lead to a proposal on a decision-making model, for example, the Lindell and Hwang's (2008) household survey of personal risk and responses in a multi-hazard environment. Their results proposed a basic causal chain from hazard proximity through to hazard experience and perceived personal risk.

Rather than dreading a hazard, strengths allow people to apply behaviours that are life saving and protecting. The emergency actions that were considered to be strengths in the Bakingili community did not directly consider gender, age, level of schooling or income. The three areas of strengths identified were rather practical and referred to being alert and listening, rushing out of homes, and preventing the inhalation of dust. These strengths simply illustrate that the community is aware of both human and environmental factors. They considered the delay of information as a critical weakness and concern: 'Delayed information is what makes us really feel insecure'.

In discussing emergency behaviours among a population that has had the experience before, it is necessary to discuss the actions that were followed. Experience is better when there is enough knowledge of the event (Lave and Lave, 1991). The inhabitants of the Bakingili community are aware of the dangers, but from their experiences they would still love to do things their own way, though the measures are, however,

rewarding. Eight responses each were recorded among the participants as prompt or emergency behaviours they would engage in. It is said that what someone likes or wishes to happen or to have, is never hidden, but rather will emerge when something close to such likes or wishes is being discussed. This also occurred during the Bakingili survey. A number of participants advocated for adequate surveillance by both government and the community. They saw evacuation as the last resort and expressed the wish for cooperation-in-action: 'The biggest emergency behaviour we have is that we will always join our hands in taking action, the lame, the blind and everybody is protected by own means 'til aid arrives'.

3.6.2 Reflecting on the input of health care workers

Banks, Shah and Richards (2007) investigated health care workers' perceptions on issues related to their ability and willingness to work and stay at work during a storm disaster. The health care staff (nurses and nurse aids) of the Bakingili community and its environs (referral points) were also researched to determine their views on the mountain and its eruptions, their way of doing, what was considered to be effective, areas of cooperation and resistance, as well as emergency behaviours. The observed responses were same as in all other disasters round the world with same difficulties lack of emergency kids to work with. Carpenter, Hodge Jr. and Pepe (2008) identified that, to be able to respond effectively to natural disasters, adequate knowledge and management kids are required. Adequate knowledge of a phenomenon is capable of enhancing protective actions. This was observed in the participatory disaster risk assessment which was examined for their potential to generate knowledge as a requirement for scaling up health worker proficiency (Pelling, 2007).

Understanding emerged in the Bakingili study and was assessed as a way of 'seeing' the mountain and its eruptions. Judging from the responses, some knowledge of the mountain is available, but could be considered to be inadequate in the effective handling of a disaster. This is because the staff is often lacking at the onset before the redeployment of others to the area. It is also because there are usually many problems to handle. These include the ailments of respirations, water and air pollution among other health problems (Afane et al. 2000, 2001; Lambi et al. 2001).

Practices of health workers are not always limited to health actions. The practices could just be coping strategies as outlined by Chang, Lee, Connor, Davidson and Lai (2008) when they assessed coping practices and the modification effects of coping. All the health care workers indicated that the fertile soils for farming and the presence of tourists were a source of assistance to them. Cone and Cummings (2006:28-36) found an unwillingness of staff to work in response to man-made disasters, but the health care workers of the Bakingili community engaged in practices that enabled them to stay longer and continue to work in the area. Health workers in communities are most often nurses who tend to act before help arrives (Hale, 2008). As such, they are always interacting with community members and they indicated continuous communication with community members concerning the health risks imbedded in the environment in which they live. This communication specifically includes the Chief due to his powerful position and standing in the community.

Health workers' way of doing and/or attitudes is often related to working commitments, particularly during disasters (Cone and Cummings, 2006). The way of doing is invariably related to a preparedness in dealing with medical and health issues during a disaster (Leiby, 2008). The preparedness among the health workers was not particularly addressed, but they indicated some strengths that aid their work during these circumstances. These focused on education, asking for help (e.g. intense communication, a relief team and supplies) and assisting during evacuations. The arrival of a relief team confirms what has happened and is still happening in many other areas. For instance, an analysis of the pre-existing emergency plan and its use during the storms included preparation and execution of plans for staffing, facility operations, communication, community resource utilisation and recovery (Banks *et al,* 2007). When health care providers work closely with other community agencies to promote

early effective interventions, difficulties could be minimised (Sartore, Kelly and Stain, 2007). Having to wait for government supplies such as relief first-aid measures and the first-aid insufficiencies were viewed as difficulties, since the available community agencies were limited in terms of communication strategies and local first-aid measures.

The above statements suggest a perceived lack of emergency preparedness, which has been found to be a common reality in most disasters worldwide. In a study on emergency preparedness and professional competency among health workers during hurricanes Katrina and Rita, there had been limited, if any, systematic examination of the preparedness of individual health care providers and their response capabilities during a large scale disaster (Slepski, 2007). The responses in the Bakingili study further highlight such difficulties, compounded by an underdeveloped infrastructure, systems and processes. The extent of the impact and consequent losses following a disaster could be indicative of an effective system, science and realities (Raphael and Stevens, 2006). In any system, a number of actors are involved. In this scenario, for example, the community, the health sector, government and the urban council in charge of all the communities in the Limbe Health Area were involved.

Lessons from Pakistan have demonstrated how simple adjustments in community outreach, staff distribution and supplies can enhance the quality, delivery and effectiveness of care provided (Miller and Arquilla, 2008: 269-73). Three areas of effectiveness were mentioned by the health workers as examples of success. These included listening to the health worker in emergency situations, using combined efforts that include the whole sector and attempting to protect water sources. Priestley and Hemingway (2006: 23-42) demonstrate the use of individual and social models in enhancing such practices, particularly when the local health personnel sees and recognises good practices as effective.

Health workers are often the experts in the field, especially regarding assessing risk and advising or evacuating persons. Wright, Pearman and Yardley (2000: 681-90) showed how experts are capable of assessing risk for referral or management in the risk perception study of the United Kingdom oil and gas production industry. The health workers of this study saw effectiveness in the way they could adequately assess risk for referral or request for relief medical aid. Promptness of reaction in an emergency situation has not only been seen as important by the nurses in this study, but was also found to be so in other cases, for example, in a survey of the risk management frame work for human health and environmental risks. The promptness of risk assessment, risk management and risk communication were found to be live saving (Jardine, Hrudey, Shortreed, Craig, Krewski, Furgal and McColl, 2003: 569-720).

Major management and research challenges are imbedded in the emergency management and communication of effects to the scientific world and the so-called consumers of remedies (Tollan, 2002: 183-190). These challenges have been found to nest themselves in communication and the logistics of emergencies. The health workers of the study described effectiveness in the way the government communicated with all actors involved in controlling the hazard and the provision of logistics as an emergency measure.

The role of local councils in response to a hazard is a social obligation and has been documented both at local and international relief effort forums (Leiby, 2008). Bearing this mind, it is not surprising that the health workers in the study reflected on the actions of the Limbe urban council that includes the study site. A number of participants stated that the Council was effective in the way it helped with some logistics, while one spoke of the space provided for the evacuees. Working closely with allied and community agencies is possible with strong cooperation ties in place (Sartore *et al,* 2007: 990-993).

Participatory risk assessment has emphasised the need for total collaboration with colleagues within and without the health sector (Pelling, 2007: 373-85). Such collaboration has been found to be empowering, since it generates new knowledge. Team spirit was discussed in this study as a cooperation method of participation together with mutual respect for views and opinions. Motivation to work has been

observed to stem from simple team spirit and mutual respect. To respond effectively to natural disasters and public health emergencies, government resources must be augmented with other resources such as councils (Carpenter *et al,* 2008: 17-23). This was observed in the Bakingili study when health workers discussed themes related to linking the council with the risk site, media and other agencies such as donors.

Resistance is a common issue in any life-threatening situation, but a common way of combating such resistance is by means of simple adjustments (Miller and Arquilla, 2007: 274-5). The Bakingili community was considered to be resistant to some extent – most importantly, in the way they held on to cultural beliefs that were in contradiction to scientific findings or data. They sometimes went as far as doubting health actions that were meant to reduce risk. These concerns regarding resistance are worth taking note of in developing an adaptable model, thus emphasising the need of a socially-informed model (Priestley and Hemingway, 2006: 23-24).

As the discussions on resistance evolved, participants raised two themes on resistance related to colleagues, namely lack of cooperation when the victims had been moved to the next referral point and non-interference with donations to help those most in need. These reflections of participants were not considered to be harmful, and Howe, Victor and Price (2008: 41-7) have shown that donations of different types may be more useful to some people than to others, requiring a collaborative and concerted effort regarding management. Issues of public concern should be treated by all parties as serious (Wright *et al,* 2000: 681-90).

Pre-existing emergency operations and plans, as well as their uses in hazardous circumstances, need to be assessed carefully (Banks *et al,* 2007: 285-295). Commitment during disasters has been identified as a health worker behaviour that affects an emergency in a positive way (Cone and Cummings, 2006: 28-36). Within this study, health care workers discussed three themes, including being present and together, joint action and joint decisions. Joint action included the sharing of knowledge with regard to the event, skills, abilities and professional competencies as identified by Slepski (2007: 99-110). This is in contrast with health disparities that were experienced by women during relief operations as documented by Miller and Arquilla (2007: 274-275).

Decision making in the health sector is often a task for both experts and an informed public. This ideal has been advanced during public awareness campaigns (Knocke and Kolivras, 2007: 169-60). Joint decisions in the Bakingili survey were found to take place between the health workers and the community as reiterated by a number of health care workers. The main actions during an emergency revolve around the protection of the population. Treby, Clark and Priest (2006: 351-9) have demonstrated this in confronting flood risk in the United Kingdom – incorporating the community's perception of risk in management models was found to be important. Thus, actions to be taken must incorporate perceptions of the risk, as well as actions geared at protection.

In this study, all six health care workers discussed, for example, the prevention of inhalations as an action to protect the population. They stated emphatically that they are not necessarily environmental experts, but listen closely to such inputs to help minimise risk to the communities. These findings were found to be similar to the findings in other studies. For instance, combined actions in risk management, identifying commonalities, strengths and weaknesses have been found to enrich an effective, current and comprehensive approach applicable to all actors in risk management (Jardine *et al,* 2003: 569-720). When problems are, however, identified, new methods are required to assess the problem further and obtain a solution (Wheater, 2006). The problem of putting health messages into practice was specifically mentioned in relation to the community applying the advice or implementing the message as received: 'If we take a message such as "no one should stay in doors when there are tremors" and someone decides not to leave his house, we would not know'. One participant stated quite philosophically that 'there is no mechanism to check this obedience'.

3.7   Conclusion

The idea of incorporating the community in all these phases is not new. Burningham, Feilding and Thrush (2008: 216-238) have underlined the importance of engaging with local perspective on risk and making local people part of the awareness-raising process. Therefore, the problem or difficulty in putting health messages into practice could be resolved by community participation at the planning, implementation and evaluation stages.

- End of Chapter 3 -

CHAPTER FOUR
ANALYSIS OF DOCUMENTARY EVIDENCE

4.1   Introduction

In the management of emergencies or threats, a range of strategies are used that vary from context to context and region to region. Proof of such disparities are often uncovered through documented evidence. The analysis of documentary sources is thus a major method of social research, and one which many qualitative researchers see as meaningful and appropriate in the context of their research project and methodology (Mason, 2004a: 103). Document analysis methods are techniques that are used to describe, categorise, critcally reflect and interpret physical sources from the private or public domain. Examples are personal papers, commercial records, state archives, communications and legislation (Payne & Payne, 2004: 60-61).

The focus of document analysis in this study was to explore and compare local, African and international strategies for the management of threats and emergencies related to volcanic activity. This included successes (strengths/opportunities) and difficulties (weaknesses/ constraints). Creswell (2003: 187) outlines the advantages of analysing direct sources of data, such as those used in the study. The limitations, however, include protection of information from the public and an inherent difficulty to source such material.

A chronic problem in the management of volcanic emergencies is the collective struggles and conflicts among parties involved, many of which are beset with faulty public policies (Macias & Aguire, 2006: 1). This problem has been observed with a number of volcanic eruption disasters around the world, Mount Cameroon eruptions included. In almost all of the cases, there were a measure of conflicting, sometimes antagonistic, scientific views, delaying any response to emergency action. In some cases, an emergency plan had already been set, for example, the Civil Defence Emergency Management Act of the Waikato region that was applied during the eruptions in New Zealand and which focused on reduction, readiness, response and recovery (the 4 Rs) (CDEM Act, 2002). Such plans have been developed in other areas, for instance the creation of a Volcano Disaster Assistance Program (VDAP) in the

United States of America, following the Armero disaster in Colombia which had already killed 20 000-24 000 people. This as demonstrated the neccessity and accuracy of the different types of documents. It thus reiterates that international literature on the nature, programmes, activities, case studies, policies, emergency management and other related publications on natural disasters in general and volcanic disasters in particular needed to be scrutinised. Marcias & Aguirre (2006: 45) are of the opinion that little if any limitation should be placed on the number and types of sources used, taking into consideration that most strategies of this nature are beset by public policy. The researcher identified emerging themes and categories from sourced material, for example, the nature of the problem as described in the literature, reactions of local indigenes, actions of the health sector and other collaborators, local perceptions of the problem and management strategies.

4.2   Focus on Cameroon

Documents have always been understood to be written text that serve as a record or piece of evidence of an event or fact and to occupy a prominent position in modern societies (Wolff, 2004: 284). The documents that gave evidence of the Mount Cameroon eruption include scientific publications, reports of the research institutes and committee resolutions.

4.2.1   Local and other publications

There is a constant threat of natural disasters in Cameroon, particularly in a chain of active volcanoes that stretches from Mount Cameroon in the south-west to the Kapsiki massif in the northern region of the country (United Nations Development Fund-UNDP, 2005). The threat ranges from volcanic emissions to many other forms of natural disaster. However, the root of the problem is considered to be the perceived poor integration of natural threats into the environmental protection realities of the country and the low level of awareness or concern of the population to the existence of these threats.

The lack of regulation governing natural threats also contributes to the overall problem of less preventive of mitigation strategies usually put in place, exposing populations to the threats. Several ministerial departments are implicated in the management of disasters, namely the Ministries of Mines, Water and Energy, Scientific Research, Territorial Administration, Public Health and the Secretary of State for Internal Security (UNDP, 2005). From the situation analysis, the UNDP set up a project with objectives that included the creation of a national observatory for risks, which includes an early warning system.

The creation of such an observatory for risks was considered critical due to the fact that the country suffered many natural disasters. Many maars and basaltic cinder cones lie on or near the deeply dissected Mount Oku massif along the Cameroon volcanic line (Smithsonian Institute Global Volcanism Program, 1999). With this wide range, the observatory's communication network needed to be apt and monitored closely and backed up by a good and early warning system. Cameroon created an emergency telecommunications and emergency management under the country's Civil Protection arm before 1999, but this was not operational. The emergency services were also handled by different ministerial departments. These included the Prime Minister's Office, the Ministry of Territorial Administration and Decentralization, the Ministry of Post and Telecommunication, the Ministry of Public Health and the Ministry of Defence (Civil Protection, 2006). The Prime Minister's Office ensures the overall supervision of these services.

Cameroon's civil protection is specifically part of the responsibility of the Ministry of Territorial Administration and Decentralization. In this ministry, there exists a Department of Civil Protection that is tasked to protect the public and to do disaster mitigation. It coordinates the operations of disaster prevention and mitigation with all the other organisations of humanitarian assistance. However, it did not indicate whether the populations at risk are aware of its existence or whether their views are taken into consideration when actions or decisions are made.

Still in this ministerial department, a national Observatory for Risks was created by prime ministerial decision No. 037/PM of 19 March 2003 (Ayanji, 2004: 4). The principal role of this observatory is to identify the high risk regions in the country and

to take necessary measures towards disaster prevention and mitigation in these areas. Again, the occupants of the relevant areas at risk are probably yet to know these officials and their relative functions and responsiblities.

An emergency medical assistance service is also in place. The Emergency Medical Assistance Service, known by the French acronym SAMU, is a medical assistance service put in place in the Ministry of Public Health. It is in charge of providing medical assistance in the case of any emergency. It is worth noting that this service is apparently active only when the disaster has occurred and not for any preventative measures.

Another service is that of emergency telecommunications. The Emergency Telecommunications Service is the responsibility of the Ministry of Post- and Telecommunications. In this ministerial department there exists an emergency telecommunications service created by presidential decree No. 2005/124 of 15 March 2005. It is responsible for ensuring that telecommunication resources are available for disaster prevention and mitigation. Amongst others, it is responsible for ensuring that the regulatory environment is favourable for emergency communications, that the necessary frequency bands are attributed for emergency communications and that the various telecommunication operators provide emergency service within their networks (Civil Protection, 2006). In general, the reason why most communities state that they are informed by government radio when a disaster occurs, and not when a disaster is about to occur, is due to lack of early warning systems. The major problems encountered by emergency communication and disaster management were defined as follows:

> The major problem encountered by the emergency communication and disaster management is the lack of means. In this respect, the Tampere Convention that gives the possibility for us to receive help from other countries and international humanitarian organizations is highly welcomed by our country (Cameroon representative, 2006).

The lack of awareness is considered to be a critical problem in Cameroon. After the Tampere Convention, Cameroon did not sign or ratify the convention. According to the

country's representative at the Convention, the non-signing was principally due to a lack of awareness. 'In fact, like most countries in the Central African sub-region, we have not been well informed of the stakes involved in the signing and the ratification of the Tampere Convention'. This means that the local communities have a significant problem related to communication. The experts' opinion about the Tampere Convention below provides a clear picture of the numerous problems faced by Cameroonians:

> It is needless mentioning that the African countries and other developing countries in general stand to benefit more from the Tampere Convention (emphasis on emergency telecommunications and disaster management) than many other countries, because they do not have the necessary financial means, technology and expertise for disaster prevention and mitigation. They need assistance more than any other countries in case of disaster. It is in this light that we are calling on the international community (UNO, ITU, IARU, WGET, etc.) to take the necessary measures towards developing the emergency telecommunication in developing countries.

4.2.2 Overview of disaster/risk management

The national disaster management framework of Cameroon was clearly explored by national development authorities and individuals. Ayanji (2004: 4-5) identifies the components of such a framework to be the legal framework, policies, intervention strategy, institutions and their actors.

4.2.2.1 The legal framework

The Disaster Management System in Cameroon was created by Law No. 86-16 of December 1986 to recognise civil protection. Law No. 98-15 of July 1998 stipulated that establishments were to be classified as dangerous, unhealthy or obnoxious. Decree No. 98-31 of March 1998 was to determine the organisation of emergency and relief plans (post-disaster measure), while Decree No. 96/054 of March 1996 determined the composition and duties of the National Council for Civil Protection. Decree No. 2004/99 of April 2004 was to recognise the Ministry of Territorial Administration and Decentralisation (MINATD) as the supervisory ministry. It is generally seen as a top down hierarchical structure (from the central level to the periphery), continuing to put more emphasis on disaster response than prevention and mitigation.

4.2.2.2 Policies and institutions

By virtue of this National Disaster Management framework, the President of the Republic, assisted by the National Council for Civil Protection, defines the policies relating to disaster risk management. Such policies are implemented by the Ministry of Territorial Administration and Decentralisation (MINATD), under the Department of Disaster and Emergency Services (which was formerly the Department for Civil Protection) and are assisted by the decentralised services of a series of specialised ministries. MINATD is represented over the entire national territory, with 379 structures responsible for the implementation of emergency response plans as set out by other nations. Disasters are handled with these 379 decentralised structures. In the event of a disaster, the emergency response plan is launched by the:

- Divisional Officer at the divisional level;

- Governor at the provincial or regional level; and

- Secretary-General at the Presidency of the Republic (national level).

The emergency plan is launched only when the competent authority (Divisional Officer, Governor, Secretary-General) has reliable and irrefutable information on the nature and scope of the disaster or grave danger. The competent authority then takes the following measures:

- sends out the alert;

- promptly initiates emergency relief activities;

- informs higher authorities;

- mobilises the necessary human, material and financial resources;

- promptly convenes the Crisis Commission; and

- informs the general public (Ayanji, 2004: 5).

The Crisis Commission is responsible for a range of activities to coordinate public relief action, direct relief operations, prepare rescue facilities, forwarding relief to the disaster area, determining the assistance and relief needs of victims, assessing immediate and after effects of the disaster and managing forms of resources provided by all agencies. In general, the Department of Disaster and Emergency Services (DDES) coordinates all the activities when a disaster occurs in Cameroon. The responsibilities of the DDES involve all elements of disaster risk management which include risk identification,

mitigation, risk transfer (calamity fund), preparedness, emergency response, rehabilitation and construction. The DDES is responsible for:

- general organisation of disasters and emergencies in the country;
- studies on disasters and emergency measures;
- relation with national and international disaster and emergency services;
- preparing training courses for disaster and emergency services staff;
- examining request for compensation and financial assistance from victims;
- controlling the use of aid;
- coordinating resources deployed for disaster and emergency services;
- evacuation; and
- monitoring the management of aid.

4.2.2.3 Intervention strategy

The activities of the DDES are different from stage to stage but are complementary before, during and after the disaster. Before the disaster, the Department promotes disaster prevention/mitigation through information, creating awareness, sensitisation and education and through activities such as:

- the organisation of activities of a day for civil protection;
- organisation of the intenational day for disaster reduction;
- speeches on disaster prevention and mitigation;
- formation of a network of civil protection communicators; and
- workshops on the requirements of a national observatory for disasters and many others that do not involve many local communities at risk.

During a disaster there is implementation of emergency response programmes (within a sectoral contingency plan) for efficient and effective disaster management. The activities include the on-the-spot coordination of emergency responses and search-and-rescue operations. After the disaster, activities related to compensation, rehabilitation and reconstruction are carried out, mainly to manage the money disbursed by central government and to follow up activities of the disaster and prevention.

4.2.3   Report: National Scientific Committee on the Mount Cameroon eruption

Documents can be referred to in order to warrant or challenge subsequent actions and decisions, even long after they were first constructed. They can also subscribe or relate to a position within a hierarchy. Documents report discussions, decisions and events to people or bodies that are senior or superior to the originators. The right to construct a document, to challenge it, to receive it and to act on it (or not) is part of the formal division of labour within many social settings (Atkinson and Coffey, 2004: 69). The reports of the National Scientific Committee on the Mount Cameroon eruption was written as a phase 1 and final report. These documents are analysed here to provide insight into reporting structures and to explain the actors and roles during the 1999-2000 eruption of Mount Cameroon. This report was compiled by Njume Emmanuel Sone (The National Scientific Committee [NSC] Secretary) on the 1st of May 1999. It consisted of an introduction, the characterisation of the eruptions and their products, hazards associated with the eruptions and recommendations.

The report continues that on the 28th of March 1999, Mount Cameroon went into its sixth eruption within the century. The eruption was preceeded by widely felt earth tremors which caused destruction of structures and panic among the populations of Buea and its environs (Njume, 1999: I). Following these events, a scientific committee was constituted for the effective monitoring of the eruption. Results of observations by this committee indicated that the eruption took place on several vents along two major north-east-south-west trending fissures on the southern flank of the mountain, one located closer to the west coast settlement of Bakingili. The eruption was characterised by a mixture of explosive and effusive activity. Products emitted included lava flows, pyroclastic materials and gases. Hazards associated with the eruption have been linked to its so-called style. While earth tremors caused landslides, damage to structures and panic among populations, lava flows destroyed enormous amounts of forest and plantations and cut across the Limbe-Idenau highway. The ash was responsible for eye and skin irritation, as well as respiratory tract infections.

The two eruption sites (NSC, 1999: 9) displayed virtually the same style of eruption. This is the strombolian type of volcanism – an explosive type of eruption which may commence with explosions followed by the emission of dark gases. At the peak, one observes the rolling and leaping of red flames (lava fountains) belched from the

mountain in huge volumes and gushed into the sky. This particular eruption, similar to those of 1909, 1922, 1954, 1959 and 1982 indicated that Mount Cameroon remains an active volcano. The constant and continuous occurance of such a natural disaster formed part of the rationale behind this study of community preparedness and emergency planning, for Bakingili in particular and for the over 15 communities in total as well.

The style and evolution of the ongoing eruption produced two types of risks, those related to seismicity and those related to volcanicity. The seismic events were responsible for the commotion and panic that particularly gripped the town of Buea and its environs. Houses were destroyed and people vacated. Repeated ground shaking resulted in some water sources turning muddy, and seismic landslides were observed on the south-eastern flank of the mountain, west of Bokwaongo. The volcanic hazards occurred mainly in two forms: explosions and effusions. Products from the explosive sites included pyroclastic materials, gases and lava flows (Gaudru & Tchankoue,1999: 2). Regarding real hazards, only the ashes are considered important. Ash fall has been observed along the west coast from Batoke through Bakingili to Idenau. Volcanic gases that were identified include water vapour and gases of carbon, sulphur and nitrogen, causing suffocation, eye iritation and a pungent odour. In the long term, continuous emission of these gases could attain proportions in the atmosphere and produce acid rain that will pollute surface waters. Lava flows appeared to be the biggest risk associated with Mount Cameroon's eruptions, though with no immediate threat to human life due to its distance from the site. The lava crossed the road, cutting off the west coast settlements (Bakingili to Idenau) from the rest of the area. Thus, the economy, society and environment were seriously affected by the Bakingili lava flows (NSC, 1999: 14)

The recommendations as stated in this report were in the form of short- and long-term measures to be taken in monitoring the eruption, as well as mitigating and/or preventing associated hazards. The government was advised to set up centres responsible for monitoring volcanoes and other natural phenomena and of mapping out mitigation strategies for hazards from such phenomena. Such centres could be located in research institutes and universities in the immediate vicinity of the mountain.

It is important to note that the short-term measures have already been taken towards mitigation and management of the immediate hazards from eruption. These included setting up the Provincial Crisis Commission (PCC) and the National Scientific Commission (NSC), as well as evacuation and settlement of populations considered to be within the high risk zones. Other short-term measures recommended included educational programmes on natural hazards, informing persons living in areas prone to earthquakes and eruptions, as well as systematic and continuous field and aerial observations of eruption sites. The above-mentioned long-term measures included accurate documentation of historic events of eruptions, the upgrading and reinforcement of the Ekona geophysical and Volcanological Observatory and the creation of new centres/observatories. Finally, it was considered important to set up public enlightenment groups in identified seismogenic areas to improve the seismic hazard awareness of such people, enabling them to participate and act accordingly during emergencies.

The report described and analysed the evolution of the March-April 1999 eruption of Mount Cameroon. The compilers of the report were mainly volcanologists, geophysicists and geographers who were residing at the local university (University of Buea), the Institute for Geological Research (IRGM Ekona) and the National Geographic Council (NGC).

Although natural hazards can usually not be prevented, their effects can be controlled and mitigated through an adequate and highly technical monitoring scheme. The government attached value to this statement by the setting up of the Provincial Crisis Commission and the National Scientific Committee who were to monitor events and provide requisite information towards mitigation of anticipated hazards, as well as to assess and evaluate damages resulting from the events. The National Scientific Committee played the role of observing and monitoring, and adequately informing the authorities, various sub-committees and the population on the day to day evolution of the eruption. The chronology of events that commenced on the 25th of March began with the first observation of anomalous signals registered by the lone seismograph at the Ekona Observatory, followed by the eruption on the 28th of March 1999. The Minister of Scientific and Technical Research and the Governor of the South-West Province set up a National Scientific Committee to monitor the eruption. The team

consisted of 24 members drawn from several ministries, research institutes and universities (Appendix 12-cross section of some members). The team was to study the location and description of eruption sites and the characterisation of eruption styles (products and their associated hazards), monitor lava flows and determine their volume, viscosity and speed, assess the impact of the eruption on the environment and the population, inform the crisis commission of developments and recommend mitigation measures.

The Scientific Committee commenced its study of the area through the use of helicopter flights to ascertain the possibility of direct field investigations, amongst others. The scientific team then presented reports on a daily basis to the commission. Such reports included developments observed at the seismograph station and results of special field missions to eruption sites at lava fronts and on west coast settlements. The team also received and briefed foreign scientists.

The eruption was preceded by a series of earth tremors. By the third day, the frequency increased to a point where seismogram signatures overlapped greatly, making it difficult to number the events accurately. On the fourth day, tremors were widely felt, seriously affecting houses (destroying some partially and others completely) and sending inhabitants rushing outside in panic. This serious shock was followed by a swarm of less serious aftershocks.

The eruption took place on two sites along the southern flank of the mountain. The first, which entered into activity earlier, was located along a south-west–north-east trending fissure. The second site, which appeared two days later, was located along a 1 km long south-west–north-east trending fissure. Along these fissures, a total of 28 volcanic vents emitted various products during the eruption. The eruption commenced at the southernmost vent. The first signs of the onset of the eruption were in the form of reddish illumination of the sky, as well as intermittent lava fountains being ejected high into the sky. At each ejection and explosion, the intensities of the glow, as well as the illumination of the sky, increased. Rumblings could be heard, particularly along the west coast. These manifestations have been linked to the sudden release by severely heated gases and of built-up internal pressures. While pyroclastic materials, ashes and gases were propelled into the air, fluid lava oozed through outlets at the base of the

eruption vents and cones. The eruption progressed from the southern end of the fissure towards the north-east, with the progressive opening of the fissure in that direction and with new vents entering into activity. At the end of the eruption, 12 vents were counted.

One week later a second eruption site was noticed. In a similar fashion, the activities commencd at the southern extreme of the fissure with an explosive phase. From this site, about thirty vents/craters of various sizes produced enormous amounts of lava, which flowed downslope towards the ocean. The anticipated effect of the lava flows on the west coast settlements, especially in their reaching the ocean, formed the basis for the decision to evacuate the population of Bakingili (then considered the most vulnerable).

The negative impact of the eruption was the result of two related phenomena: seismicity (occurrence of earthquakes) and volcanicity. The earth tremors were widely felt. The shock wave was responsible for serious damage to man-made structures. The Poto-poto quarter in Bokwaongo, Sasse College, Bishop Rogan College, Bwassa and Bojongo were amongst the regions that were hit the hardest. Products of the eruption have had varying effects on the environment, economy and society (see Appendix 13).

The Committee made the following recommendations, noting that eruptions and their associated activities were natural phenomena, the occurrence of which cannot be prevented. However, through an adequate monitoring scheme, they can be predicted in terms of time and location. Such predictions are the foundation for any mitigation measures geared towards environmental and civil protection. While short- and long-term measures have been recommended, the most important ones are:

- the need to put in place well-equipped monitoring centres around the mountain;
- the need to put in place an adequate road network around the mountain to facilitate evacuation when the need arises;
- the need to carry out sensitisation and educational programmes geared towards increasing the seismic and volcanic hazard awareness of population around the mountain;
- the setting up of a permanent National Scientific Committee on the monitoring/investigation of the activities of the mountain and other natural hazards; and

- putting in place of necessary means to sponsor post-eruptive studies which will adequately characterise and interpret the 1999 eruption (Scientific Committee, 1999: 1-27).

No volcanic early warning system is considered helpful without the collaboration of local populations, before and during the eruptions (Gaudru and Tchankoue, 1999: 2-3). Despite the fact that some of the local people had also lived through the 1982 eruption, it was interesting that local populations continued to see eruptions of Mount Cameroon not as a natural phenomenon that could be predicted, but as manifestations of ancestral sanctions. An improved education of local people regarding their attitude towards forthcoming volcanic activities is a great challenge to geoscientists, and seems just as important as heavy investments for an efficient early warning system.

4.2.4   National health policy

This document was intended to address a ten-year period and was termed the 'National Strategic Plan 2001-2010'. In general terms, it addressed socio-cultural issues such as 'accessibilité socio-culturelle' in which health workers should organise services to suit the cultural environment within which they work (p. 87). It also contained referrals to information, education and communication and the development of partnerships and operational research (p. 119). The lives in communities were also addressed '[e]n milieu, l'ignorance et la difficulté d'adapter certaines pratiques culturelles aux exigence moderne contribuent a agraver cet etat de chose' (p. 123). The document took cognisance of ignorance in general and did not address eruption hazards in any specific way.

4.3   Focus on Africa

Africa is the only region other than the Mediterranean with a historically dated B.C. eruption (Simpkin and Siebert, 1994). A Mount Cameroon eruption was observed by a passing Carthaginian navigator in 5 BC By 15 AD, however, the Portuguese exploration of Africa had begun and Vasco de Gama sailed to India via the Cape of Good Hope. By then, only two more eruptions were recorded, both from Ethiopia. In the next third and two-thirds of a century, another 20 eruptions were recorded, but the main historical record of the continent began with the opening of the Suez Canal at the end of 1869,

and the heyday of exploration that followed (Sparks, 2005:3). This is indicative of the fact that communities need to strengthened to be able to manage any eruption hazards before the arrival of aid, and/or be able to join effectively when aid arrives.

Most African volcanoes resulted from hotspots, the rifting in East Africa, or a combination of the two. The East African rift, one of the world's most dramatic extensional structures, produced the continent's highest and lowest volcanoes, ranging from the massive Kilimanjaro, to vents in Ethiopia's Danakil Depression that lie below sea level. Two neighbouring volcanoes in the Democratic Republic of the Congo's Virunga National Park, Nyamuragira and Nyiragongo, are responsible for nearly two-fifths of Africa's historical eruptions. Africa has the highest percentage of volcanoes that are undated but known to be Holocene, reflecting the early stage of detailed geologic studies. The continent has the most volcanic centres, with pyroclastic cones and fissure vents as primary features, many of which lie within the East African Rift (Simpkin and Siebert, 1994).

4.3.1 Erta Ale: Ethiopia

Erta Ale is an isolated basaltic shield volcano that is the most active volcano in Ethiopia. The broad 50 km wide volcano rises more than 600 metres from below sea level in the barren Danakil Depression. Erta Ale is the namesake and most prominent feature of the Erta Ale Range, a high volcano with an elliptical summit crater housing steep-sided pit craters. Fresh-looking basaltic lava flows from the fissures have poured into the caldera and locally overflowed its rim. The summit caldera is renowned for one, or sometimes two, long-term lava lakes that have been active since at least 1967, but possibly since 1906. Recent fissure eruptions have occurred on the northern flank of Erta Ale (Smithsonian Institution Global Volcanism Program, 2003). Risk mitigation actions are often taken when it occurs. Effective communication has been considered the main mitigation method. Thus, communication was constituted as the first step in the step-by-step model of this study.

4.3.2 Kilimanjaro

Mount Kilimanjaro in Tanzania is the highest (5 895 metres) and most famous mountain in Africa and is located in Tanzania adjacent to the Kenya border. Three distinct volcanoes are located here, namely:

- Kibo (centre volcano) with the highest peak and a permanent glacier and snow field at its summit;

- Shira (most western, the oldest that eroded into a plateau-like feature standing 3 778 metres above sea level); and

- the easterly with a well-defined peak that reaches 5 354 metres above sea level.

The overlapping lava flows from these three volcanoes have almost obliterated their individual uniqueness into a single complex volcanic feature. The southern flanks of the mountain are more deeply eroded than the northern slopes. Perhaps the cloud building indicates that the severity of erosion is caused by more precipitation on the southern slopes than on the northern slopes (NASA, Earth from Space, 2001 in Smithsonian Institution Global Volcanism Program, 2003). Monitoring of the volcano is constantly being carried out. The monitoring observed from this study has also informed the adaptable model of this study and appears in the step two of the model.

4.3.3   Marion Island

Marion Island is South Africa's only historically active volcano and lies at the south-western end of a submarine plateau immediately south of the south-west Indian Ocean Ridge, opposite Prince Edward Island. The low profile of the 24 km wide island is formed by two young shield volcanoes that rise above a flat-topped submarine platform. The 1 230 metre high island is dotted by about 150 cinder cones, smaller scoria cones and coastal tuff cones. More than 130 scoria cones and many lava flows were formed during the Holocene. Many of these appear to be younger than the 4 020 BP peak overlying one of the flows (Verwoerd *et al* 1981, in Smithsonian Institution Global Volcanism Program, 2003). A meteorological station is maintained at the island by the South African government. The critical aspect of this work- monitoring that thus adds the ingredient of meteorological surveillance.

4.3.4   Mount Nyamuragira

Africa's most active volcano, Nyamuragira, is a basaltic shield volcano that rises north of Lake Kivu across a broad valley north-west of the Nyiragongo Volcano in the DRC. The volcano has a volume of 500 km^3 and extensive lava flows from Nyamuragira to cover 1 500 km^2 of the East African Rift. The 3 058 metre high summit is truncated by a small summit caldera that has walls up to about 100 metres high. Historical eruptions

have occurred within the summit caldera, frequently modifying the morphology of the caldera floor, as well as from the numerous fissures and cinder cones on the volcano's flanks. A lava lake in the summit crater, active since at least 1921, drained in 1938. Twentieth century lava flows extend down the flanks of the summit, reaching as far as Lake Kivu (Smithsonian, 2002).

4.3.5 Mount Nyiragongo

One of Africa's most notable volcanoes, Nyiragongo contains an active lava lake in its deep summit crater that drained in 1977. In contrast to the flow profile of its neighbouring shield volcano, Nyamuragira, Nyiragongo displays the steep slopes of a stratovolcano. Benches in the steep-walled, 1,2 km wide summit crater mark former lava lake levels. Two older stratovolcanoes, Baruta and Shaheru, are partially overlapped by Nyiragongo on the north and south. Approximately 100 parasitic cones are located primarily along radial fissures south of Shaheru, east of the summit and along a north-east–south-west zone extending as far as Lake Kivu. Monitoring is done from a small observatory building located in Goma, approximately 18 km south of the Nyiragongo crater. A previous lava lake in the deep summit crater of Nyiragongo, first reported by GA von Gotzen on 11 June 1894, drained suddenly through radial fissures on 10 January 1977, killing about 70 people. Lava lake activity resumed in June 1982, but had ceased by early 1983. The lava lake was activated after an eruption that began in June 1994 (Smithsonian, 2003). The contribution from this mountain and its activities is that certain activities need to be negotiated, by informing policy on the past experiences, risks and possible mitigation, also found in step three of the suggested model.

4.3.6 Oku volcanic field

Numerous maars and basaltic cinder cones lie on or near the deeply dissected Mount Oku massif along the Cameroon Volcanic Line. Two of these crater lakes, Lake Nyos to the north and Lake Monoun to the south, have produced catastrophic gas release events. According to the Smithsonian website, the gas release on 15 August 1984 at Lake Monoun killed 37 people. The death toll was attributed to an overturn of stratified lake water, triggered by an earthquake and landslide. The Lake Nyos event on 21 August 1986 caused at least 1 700 fatalites. The emission of around 1 km^3 of magmatic carbon dioxide has been attributed to the overturn of stratified lake waters as a result of a non-

volcanic process, or to phreatic explosion or injection of hot gas into the lake. It is presently being monitored and degased to prevent or mitigate against such hazards in any future emissions. The survivors were made to return when bills boards have revealed that the risk and what should be engaged in when any such danger is perceived. This experience has add empetus to the step four of the model for the Bakingili community.

4.4   International focus

Emphasis has been placed on the facilitation of volcanological knowledge and expertise in threat communication, mitigation, community development, emergency planning and response management (Paton *et al*, 1997: 2). All initiatives must be designed to ensure the safety of people or property by preventing, reducing or overcoming hazards (CDEM Act, 2002). New Zealand, for example, had suffered from a number of natural hazards and, as early as 1783, the Civil Defence Act was passed which was replaced by the CDEM Act of 2002. The CDEM Act of 2002 ensures that New Zealand has the necessary resources to manage disasters. Thus, the emergency management focuses on the 4 Rs:

- Reduction: identifying and analysing risks to human life and property;
- Readiness: developing capabilities before an emergency occurs;
- Response: taking action immediately before, during or directly after an emergency; and
- Recovery: initiating activities after impacts, and extending them until the community's capacity for self-help is restored (www.ew.govt.nz/regional services/civil/index.htm).

Therefore, the concept of communication, mitigation, community development, emergency management and response (Paton *et al*, 1997; 2) could in general be used in combination with New Zealand's CDEM Act of 2002 (the 4Rs). Marcias and Aguirre (2006: 45) stated that:

> a chronic problem in the management of volcanic emergencies is the collective struggles and conflicts among the parties involved, many of which are beset

with faulty public policies. Examples abound in the literature associated with this field, including the Taal Volcano..

Many of the volcanic activities have demonstrated the possibility and reality of conflicting scientific views that may impact emergency responses and influence public policies which may cause the critical risks that are faced by the populations most threatened by volcanic eruptions to be overlooked (Balkie *et al*, 1994).

One result of these disasters, is the creation of assistance programmes whose functions may be limited to the particular disaster or kept in place to manage all subsequent disasters. One of the consequences of the Armero disaster was the creation of the US-based Volcano Disaster Assistance Program (VDAP) and the United Nations Disaster Relief Organization (UNDRO) proposed by the United States Geological Survey (USGS) (Meliti *et al*, 1999). Thus, the UNDRO-USGS management scheme was established.

Many countries in Latin America and elsewhere adopted the UNDRO-USGS management scheme. Its basic tenets assume that people are aware of volcanic hazards and wish to protect their communities, that laws are available at local, regional and national levels for protective measures, that ample scientific knowledge to construct alternative scenarios of eruption and their destructive effects exist, that warnings are disseminated with sufficient lead time for people to take protective action, and that an emergency plan can be put into place (Marcias and Aguirre, 2006: 46).

Similar to other such programmes, the manual includes actors, such as scientists charged with monitoring (not intervening in the activities of civil authorities in charge of protecting the population), an emergency management committee (public officials and representatives of other community organisations), and an effective mass communication that disseminates decisions (ibid). The scheme assumes that a variety of technical resources, as well as preparedness and response programmes for the authorities and threatened populations, are already in place. The management information international literature contributed in the nature of information on bill boards, leaflets, and handy methods of mitigation.

4.4.1   The Vanuatu active volcano

Ambae is an island in Vanuatu with an active volcano. It is the largest of Vanuatu's volcanoes and is also potentially one of the most dangerous. In 1995, small phreatic explosions, earthquake swarms and heightened gas release led to calls for evacuation preparations and community volcanic hazard awareness programmes for the 9 500 inhabitants (Cronin *et al*, 2004a: 347-9). Despite this threat, one of the main challenges facing hazards and risk management in Vanuatu and other countries of the South Pacific region is to make sure that communities, through the national-level planners, utilise scientific information within practical risk reduction policies and programmes. Unfortunately, differences in perspective or worldview between the island dwellers adhering to traditional beliefs and external scientists and emergency managers led to a climate of distrust following existing crises of conflicts between the two groups and ideas. Some participatory rural appraisal (PRA) approaches were adopted and applied in an attempt to address the issues and to rebuild dialogue and respect between communities, external scientists and administrators and to forward in volcanic hazard education and planning for Ambae.

4.4.2   Chichonal volcano

The Chichonal volcano is situated about 70 km from Tuxtla Gutierrez, the capital city of Chiapas, Mexico. Its eruption in March-April 1982 killed at least five thousand people, mostly from the Zoque ethnic community. There was no monitoring equipment on site, with the exception of a set of seismographs that had been installed by the federal electricity commission, intended for the monitoring of seismic activity around nearby dams.

The Mexican Army was the primary federal agency in charge of responding to this disaster. It arrived at the scene two days prior to the deadly eruption. Due to a certain degree of poor coordination between the army and local communities, evacuation efforts did not begin until after the next eruption. 'Perhaps some blame can be directed toward the army's decision to respond with a military plan' (Marcias and Aguirre, 2006: 47), following the suggestion of local geologists with no experience in either volcanoes or disasters. Following this advice, the authorities used the mass media and other means to convince the Zoque ethnic communities to stay in their homes. Unfortunately, a few days later a massive eruption occurred, killing a large number of

inhabitants. As the army evacuated the survivors, they segregated them by gender and age, thus disrupting family networks. Finally, many people were evacuated and not much is known about the survivors.

4.4.3   Popocapetl volcano

This volcano, 45 miles south-west of Mexico City and 30 miles south-west of the Puebla, currently threatens more than 20 million people (Marcias and Aguirre, 2006: 47). It is one of the most active volcanoes in Mexico, with 15 eruptions since the arrival of the Spaniards in Mexico, though most eruptions have been mild. It became active a few days before Christmas in 1994. With the Chichonal and Nevado del Ruiz volcanic eruptions as a backdrop, Mexican officials adopted the UNDRO-USGS model to address the dangers posed by the Popocapetl volcano. The scientific committee for the Popocapetl volcano was established in 1995 as part of the response to the eruption of 1994 and included five of the most reputable geologists in the country. Moreover, the National System of Civil Protection, through the initiative of the then director of the National Centre for the Prevention of Disasters, created a national committee to give comprehensive technical assistance regarding the Popocapetl volcano and other volcanoes and hazards. The committee assessed the volcano and other committees on geologic, hydro-meteorological, chemical and public health hazards, as well as a sub-committee composed of social scientists.

4.5   Content analysis: some critical deductions

The record of evidence of an event or a fact has been said to occupy a prominent position in modern society (Wolff, 2004). The main sources or records used in this study were also assessed in terms of how often they appeared, how frequently they were seen and how prominent they were in the various documents. Document analysis is important as it can fulfill a number of functions for the qualitative researcher (Mandava and Knowles, 2005: 2-12). Information on issues that cannot readily be addressed through other methods is provided in this manner (Bryman, 1989). It remains an important mechanism for checking the validity of information derived from other methods. This is based on the fact that words and phrases mentioned most often are those reflecting important concerns.

Two types of content analysis (quantitative and qualitative) are available. Quantitative content analysis starts with word frequencies, space measurements and time counts, while qualitative content analysis involves any kind of analysis where the content is categorised and classified. For making inferences, the analysis, in general, uses frequencies that are coded into categories and then developed into themes. To make valid inferences from the text, it is therefore important that the classification procedure be reliable in the sense of being consistent (Weber, 1990). The analysis is limited to manifest content, that is, the words, phrases, sentences or the general text rather than their meanings (Krippendorff, 2004).

Qualitative content analysis was carried out in this study. The occuring categories/ themes constituted words, like the nature of the hazards, management/ mitigation, success stories and challenges. These observed in all the documents studied and themes are as discussed below.

A number of countries are prone to natural disasters due to the potential of volcanic eruptions, eruptions that cannot be prevented. However, the effects of these eruptions can be controlled and mitigated with early recognition, preparedness and swift emergency management. Eruption may take place at more than one vent, involve more than one community and the vents may emit hazardous products such as lava flow, harmful gases and ash. This add to step one of the model which is linked to recognition of the hazard.

One other theme is related to directive frameworks which are linked to step two, indicating that a link to existing directive frameworks is safe. The UNDRO-USGS model could be a starting point, but needs to be adapted to country and local needs. The need is for an in-country legal framework that provides guidance at all levels and clearly outlines the composition, objectives and responsibilities of structures and organisations. These should include academic/scientific institutions where volcanologists, geologists, geographers and social scientists are involved, as well as government structures, health services and civil organisations. Coordination of a range of ministries is a tough task and a national disaster framework could guide such processes. A critical aspect of such a framework is communication lines, as the confrontation of a hazardous situation is made easier with an effective early warning

system. Precautionary guidance without any early warning system may be difficult and ineffective (Wheater, 2006). Other aspects of the guiding directive frameworks are monitoring, mitigation, preparedness, investigative actions (including arial observations), emergency responses, managing aid (health, financial and logistical), evacuation, etc. If one reflects on national and international aid, the case of the Indian Ocean tsunami of December 2004 comes to the fore. It was one of the most significant natural disasters in modern history and the response it drew was unprecedented on local and international levels (Raphael and Stevens, 2006).

A theme related to services emerged, which underline the need for well-established services to monitor for signs of such possbile disasters. Other services mentioned is an effective telecommunication (that also entails early warning systems) and health care emergency service. The presence of a number of complex ministerial departments and/or initiatives may complicate matters and influence quality service provision when it really matters. One ministerial department may wait for another to start and the community might even be aware of their existence. The step of model has considered exposing the ministerial departments and their roles to the community. The absence of or limited community involvement may also be a complicating factor. Collaboration is thus crucial, inclusive of international assistance. To respond effectively to any natural disaster and other public health emergencies, government resources must be augmented with the resources of extra hands, the use of volunteers not excluded (Carpenter *et al*, 2008).

Reflection on the theme of community involvement brings to the fore the urgency of dialogue on equal footing, collaborative planning, preparation and education. Such educational initiatives are to include both community members and health workers from the areas and from farther away. The issues of health education (including dealing with cultural beliefs and religious practices effectively), emergency health care, health care rehabilitation and health monitoring are critical. Managing the cultural beliefs, distrust, resistance, fear and panic of a community being severely threatened and affected is not easy and requires special preparation, especially if one trusts and supports the importance of family networks and togetherness. Unfortunately, a number of research projects has often focused on the quantification of disaster effects regarding characteristics under various conditions with limited attention to civil protection

(Tollan, 2002). The United Kingdom's Environmental Agency prioritised the need to increase public flood risk awareness by using means that will be acceptable and accessible and by engaging with local perspectives on risk, making local people part of the processes of raising awareness (Burningham *et al*, 2008).

In general, the issue of community wellness, specifically related to the harmful health effects of such an erpution, both short- and long-term, surfaced consistently. Apart from the life-threatening realities of coming into contact with the lava flow and superheated gases, eye, respiratory and public health issues such as water pollution came to the fore. Raphael and Stevens (2006) note that, although a range of specific impacts and losses may be predicted within affected populations, there is substantial evidence that the adverse impacts could take various forms, requiring different forms of management. It is important to note that planning for and managing a disaster scene involve the use of nurses as front line staff. Hale (2008) identified the largest group of health care professionals in the United States as nurses, who are also part of every community, and may be called upon to initiate emergency responses and provide initial planning for health care until local, national or federal assistance arrives.

In conclusion, the dominant messages within the subject matter was lack of finances, the absence of meaningful collaboration at all levels, ineffective communication, limited health care management, poor risk management and education. These issues were very prominent in the text or most often referred to. The need for preventative actions to protect communities was also often mentioned, but veiled in complex realities of cultural practices and livelihood, a reality that continuously came to the fore in this study.

- End of Chapter 4-

CHAPTER FIVE
LITERATURE REVIEW

5.1   Introduction

Badenhorst (2008:12) states that, in an academic context, all research is probably based on previous research. Therefore, the literature used to inform and guide the development of the model focused on the following:

- volcanic eruptions and other disasters, including locations, classifications, effects, social and other critical issues;

- international policies and related organisational directives;

- health care issues related to volcanic eruptions such as disease and disability, including health hazards, quality of life, health care management strategies, the influence of cultural practices, religion and spirituality and its uneasy relationship with modern day health care and other sciences;

- models (description and functions), model development processes and community health models.

5.2   Volcanic eruptions and other disasters

Volcanic eruptions around the world have exhibited similar styles of eruption. Their inherent risks have been recorded by many volcanologists (Dominey-Howes & Minos-Minopoulous, 2004; Gregg, Houghton, Johnson, Paton, Swanson, 2004a and b; Dibben and Chester, 1999). The human aspects of risk and disaster have also received attention at international geological conferences (Wilson, 2008). In the editorial, Wilson (2008) states that numerous conferences have been held as a means of bringing together scientists working in the field to address the realities related to such major disasters, including the human aspect. Thus, the development of a holistic approach to the reduction of harm associated with volcanic activity is apparent. Disasters and natural disasters in particular, may be defined as the following:

> The consequences of events triggered by natural hazards that overwhelm local response capacity and seriously affect the social and economic development of a region, are traditionally seen as situations creating challenges and problems mainly of a humanitarian nature. It is important to

understand, however, that the magnitude of the consequences of sudden natural hazards is a direct result of the way individuals and societies relate to the threats originating from natural hazards. The magnitude of the consequences is, thus, determined by human action, or the lack thereof (Operational Guidelines on Human Rights and Natural Disasters, 2008: 3-editorial).

Thus, the types or classifications, effects and critical realities of volcanoes and other disasters will be examined.

5.2.1 Types of volcanoes and other disasters

Disasters have occurred in different forms and magnitudes in various parts of the world. According to the CDC natural disaster isolation (CDC Natural Disasters, 2008), types of disasters should not exclude weather emergencies. Disasters include earthquakes, extreme heat conditions, floods, hurricanes, landslides, mudslides, tornadoes, tsunamis, volcanoes, wildfires, and winter weather. Human beings have been coping with the effects of such disasters for a number of centuries, and any disaster at any given time gives rise to renewed interest and research related to that phenomenon and the experience of those involved. For example, the increasing number of floods in the United Kingdom brought about a renewed interest in flood risk management (Wheater, 2006), while the recent earthquake in California has undergone an extensive investigation (CDC earthquakes, 2008).

Volcanoes may be categorised according to various types but are generally classified as active or non-active. The active volcano erupts because of seismic activity and may emit hot, dangerous gases, ash, lava and rock that are powerfully destructive (CDC Volcanoes, 2008). The most common cause of death occurring as a result of volcanic eruptions is suffocation. Additional health threats caused by floods, mudslides, power outages, contaminated drinking water and wildfires may be experienced as a result of volcanic eruptions (ibid).

5.2.2 The effects of volcanic eruptions and other disasters

The effects of disasters have been experienced throughout the world. Tsunamis, hurricanes and earthquakes that hit parts of Asia and the Americas in 2004/2005 have highlighted the need for awareness with regard to the multiple human rights challenges facing those affected by such disasters (Operational guidelines on natural disasters, 2008: 3). Droughts alone, have proven to be a major cause of concern in rural New South Wales communities since late 2001 (Sartore, Kelly & Stain, 2007). Furthermore, the authors claim that 'while much is known about the effects on mental health of acute natural disasters, there is less research available on the effects to [sic] communities of chronic natural disasters'.

Kunreuther & Michel-Kerjan (2008) mention the extreme events that have killed large numbers of people all over the world. In South-East Asia, for example, the Tsunami that occurred in December 2004, killed more than 280 000 people along various coastal areas. The cyclone, Nargis (which created a landfall in Myanmar in May 2008), killed an estimated 140 000 people. During the same month, the Great Sichuan earthquake in China is estimated to have killed nearly 70 000 people. The authors underline the urgency of developing a coherent risk reduction and adaptation strategy to avoid future catastrophic human and economic losses in low- and middle-income countries. In an attempt to create a more holistic outline of the effects of disasters, members of various communities have been studied. According to Siegrist & Gutscher (2006), many inhabitants of flood risk zones are unaware of the existence of flooding maps pertaining to their region, while members of other communities have been known to overestimate the risk associated with the flood. It may therefore be concluded that some people may be more afraid of flooding than is justified by scientific data.

The health concerns following a volcanic eruption include infectious diseases, respiratory illnesses, burns, injuries from falls, and vehicle accidents related to the slippery, hazy conditions caused by ash (CDC volcanoes, 2008):

> Exposure to ash can be harmful. Infants, elderly people, and people with respiratory conditions such as asthma, emphysema, and other chronic lung diseases may have problems if they breathe in volcanic ash. Ash is gritty, abrasive, sometimes corrosive, and always unpleasant. Small ash particles can abrade (scratch) the front of the eye. Ash particles may contain crystalline silica, a

material that causes a respiratory disease called silicosis. Most gases from a volcano quickly blow away. However, heavy gases can collect in low-lying areas. The most common volcanic gas is water vapor, followed by carbon dioxide and sulfur dioxide. Sulfur dioxide can cause breathing problems in both healthy people and people with asthma and other respiratory problems. Although gases usually blow away rapidly, it is possible that people who are close to the volcano or who are in the low-lying areas downwind will be exposed to levels that may affect health. At low levels, gases can irritate the eyes, nose, and throat. At higher levels, gases can cause rapid breathing, headaches, dizziness, swelling and spasm of the throat, and suffocation (ibid).

There is a dearth of scientific literature on the immediate effects of volcanic eruptions on surrounding vegetation. The first description of the impact of heavy ash falls on forests was recorded in 1936, where, in the forest of Panjang and Sertung there was a mechanical overloading of small trees, branch loss of large trees and the destruction of a number of other trees (Whittaker, Walden & Hill, 1992). These were linked to the physical effects of the volcano covering the vegetation as was also observed in the Mount Cameroon eruptions. Other effects include livestock losses and damage to property as well as the destruction of infrastructure such as water, electricity supply lines, water, communication systems, schools, hospitals and churches (Ayanji, 2004: 4).

The general effects of disasters on society have also been documented. Smith (2009) observed the social effects of flooding disasters in Minnesota and recommended that property owners document their losses and damages by taking photographs or by making a list thereof, followed by the removal of personal property damaged by flooding (Perry & Lindell, 2008: 172). This apparently led to the decision of the authorities to begin cleaning up homes and personal property as soon as possible. Waukon (2008) observed the social effects caused by another flooding in Iowa and suggested rebuilding the place in order to ensure safety, strength and improvement. Lowa was hit by a series of storms, floodwaters and tornadoes between May and August 2008. Spennemann (1995: 1-2) observed the critical loss of cultural heritage: 'Insufficient knowledge on the importance and management of such places leads to well intentioned mitigation efforts which unfortunately impair or destroy cultural heritage… The aftermath of the Loma Prieta earthquake has shown that many heritage buildings have been "red-tagged", declared to be unsafe and were subsequently demolished as a public safety exercise' (Spenneman, 1995: 2).

5.2.3 Critical realities related to disasters in general and volcanic eruptions in particular

It would be a fallacy to think or assume that just because similar phenomena can be identified in various worldwide settings, they have the same meaning everywhere. Usually, risk perception and other critical realities have been studied primarily by means of psychometric and econometric methods, which have revealed voluntary rather than involuntary risks in the community (Starr, 1969). Scientists have now come to realise that people's perceptions with regard to risks include a wider range of dimensions seen to threaten the comfort of individuals (Slovie, 1998 in Wilson, 2008; Fischoff, Slovie, Lichtenstein, Read & Combs, 1978). The three dimensions identified are dread, familiarity and the number of people exposed.

The CDC (2008) considers the following critical issues during disasters, i.e. those found to be present in almost all disasters such as illness, injury, food and water problems, animal and insect presence, returning home after a disaster, toxic gases that pollute the air (carbon monoxide), environmental damages or concerns, cleaning up and power outages. This list seemingly excludes mental health issues. Raphael and Stevens (2006) and Sartore *et al* (2007) stated that there is substantial evidence that the adverse effects on mental health may represent one of the most significant outcomes of such events. The lahars from volcanic eruptions usually pose a health problem, but social behaviours, risk perception or knowledge may favour their proliferation. Guillard (2008) demonstrated that even when volcanic hazards, such as the threat caused by lahars, are clear, due to their frequent recurrence and dangerous nature; the structural constraints have a direct influence on the behaviour of those affected. The Mount Pinatubo eruptions in the Philippines demonstrated that once irrational behaviours were more fully explored within their social and economic settings, they can be understood as being relatively rational and explicable.

The location of the volcano may be such that the behaviours displayed vary – each volcanic context has its own physical environment, cultural heritage, social, political and economic background (Wilson, 2008). Therefore, no two cases are likely to be similar. The author is therefore convinced that a meaningful and deep understanding of

a local society plays a vital role in conducting effective disaster risk/hazard reduction and health care management.

5.3   Volcanic eruptions in terms of international policies or emergencies

Literature on volcanic eruption policies or emergencies focuses on the theme of preparedness before, during and after the eruption. The threats often associated with volcanic eruption hazards are numerous. Some of these can be predicted ahead of time while others may occur unexpectedly after an eruption has occurred. Each volcano and situation is unique. It is clear that emergency arrangements and policies have, at times, been devised primarily in response to the vulnerability of the situation. In Italy, insightful information concerning the vulnerability of the Vesuvius volcano was traced to factors such as high population density, and socio-economic marginalisation (Chester, Dibben, & Duncan 2002). Policies may thus depend on or relate to social responses. For instance, Chester (1993) explored people's responses to volcanic hazards in both the developing and industrialised worlds. He concludes that societies' responses are complex and vary in time and space, and underlines the importance of anthropogenic factors in such complex situations.

Literature has not been silent on resettlement options during volcanic eruptions. The Merapi volcano in Java, Indonesia, demonstrated the need for evacuation following activities that were seen to pose a threat to human safety. Laksono (1988) describes how inhabitants living on the flanks of the volcano returned to their original homes soon after the government resettled them in Sumatra. These people were found to be unhappy with the resettlement as they were of the opinion that the place of evacuation posed a greater risk than their own homes, which were situated on the slopes of the active volcano (Dove, 2008; Schlehe, 1996).

It is important to note that other human factors may expose people to one or more of the volcanic risks. Dibben (2008) has argued that while poverty plays a significant role, it is not only in situations of poverty that risk-increasing behaviour seems dislocated from the perception of risk. At the Etna volcano site in Italy, it was found that people choose to live in situations of volcanic risk because of the variety of benefits it offers. Dibben (2008) continues that any feelings of discomfort arising from living in a situation of

volcanic risk are reduced through collectively held representations of a beneficial landscape.

5.3.1 Before the eruption

It has been documented that volcanic eruptions are preceded by tremors which may have a mild beginning and then gradually become more severe or which may have a sudden severe onset. Therefore, the international community has proposed many actions or key facts about preparation for volcanic eruptions. 'The best way to protect yourself and your family is to follow the advice of local officials. Local authorities will give you information on how to prepare for a volcanic eruption, and if necessary, on how to evacuate (leave the area) or take shelter where you are' (CDC Volcanoes, 2008). Essentially, this advice focuses on the necessity of creating a shelter or evacuation plan which should be made for the entire household, including the neighbours). One is then advised to check whether the emergency supply kit is in order or to put one in place if none exists. The CDC Volcanoes (2006) recommend that the emergency supply kit should include a flashlight and extra batteries, a first-aid kit, emergency food and water, a manual can opener (non-electric), essential medicines, sturdy shoes, respiratory or breathing protection, eye protection wear such as goggles, and a battery-powered radio. Respirators should be used while outside or when cleaning ash found indoors. An N-95 disposable respirator has been recommended. In addition, it has been suggested that one should only go outside for short periods of time. However, local provision could be made for nuisance dust masks. At times, evacuation is a necessary procedure as the products of eruptions could be very dangerous. Important actions include listening to the radio or television for volcanic updates, listening for disaster sirens and warning signals, reviewing of one's own emergency plan and gathering emergency supplies, preparing a vehicle if you have one available, filling clean water containers, as well as preparing additional water containers and filling them with water for washing and other purposes.

During evacuation, it is recommended that only essential items be taken, including at least one week's supply of prescription medicines if required. Turn off the gas, electricity and water if time allows and follow designated evacuation routes. Sometimes an order to take shelter rather than to evacuate is recommended: 'If you are told to take shelter where you are, keep listening to radio or television until all is said to be safe or

asked to evacuate, close and lock all windows and doors. Turn off all heating appliances and fans, close the fireplace, organise emergency supplies, make sure the radio is working and go to interior rooms without windows' (CDC Volcanoes, 2008a).

5.3.2 During the eruption

During a volcanic eruption, it is best to follow the advice of the local officials (CDC Volcanoes, 2009). The website further elaborates on volcanic flows and actions to be taken, for example, if it is a lahar, pyroclastic flow, or lava flow headed towards people, it is of paramount importance that one leaves the area immediately while keeping a lookout for unusual hazards in the road. If one is indoors, it is important to close all windows, doors and fireplace or woodstove dampers and to turn off all fans and heating systems. Bring pets and livestock close to shelters. If out of doors, seek shelter indoors; roll into a ball to protect the head in case of being caught in a rock fall; move upslope if you are near a stream or river to avoid rising water and mudflows; seek immediate care for burns; move away from the area at once if eye, nose and throat irritations occur and consult a doctor. During ash fall, one needs to protect the nostrils with a respirator, cover the body with long-sleeved clothes and use goggles to protect the eyes. If the weight of the ash is severe, it is better to remain outdoors as the ash may collapse the building. One should also listen to the advice given by officials to leave the area if ash fall lasts for more than a few hours (CDC Volcanoes, 2009).

5.3.3 After the eruption

The contributions made by local authorities and mass media have proven to be highly valuable in terms of minimising volcanic hazards. CDC Volcanoes (2009) has again proposed that individuals and groups pay attention to warnings and obey directives from local authorities. Examples include staying indoors until informed by officials that it is safe to go outside. Listening to local news updates for information concerning air quality, the safety of drinking water, and the state of the roads in combination with all the other instructions before and during the eruption is of the utmost importance (CDC Volcanoes, 2009).

5.3.4 International policies/emergency plans

When discussing these policies and emergency plans, it has been observed that a number of constraints are found both in developing and industrialised countries such as Indonesia, the Philippines, Italy, Montserrat and other parts of the world (Wilson, 2008). This is an important finding, since it has often been assumed that what should be done in developing countries may not necessarily apply to industrialised countries. In Italy, for example, Dibben (2008) has shown how the search for an improved quality of life was encouraging people to move out of the city of Catania towards the foothills of Mount Etna despite obvious volcanic threats and the availability of 'safer' alternative sites. Even religious complexities are not limited to developing countries. Chester *et al* (2008) have pointed out that religion may similarly prove to be a powerful influence on people's behaviour not only in pre-industrialised societies, but also in Europe.

Marcias & Agguire (2006: 1) remark that 'a chronic problem in the management of volcanic emergencies is the collective struggles and conflicts among parties involved'. Thus, we find a situation where good policies may be nullified or constrained by conflicts. Such policies, in their opinion, are often beset by limited or faulty public policies. The problem has also been observed that conflicting scientific views and/or policies have delayed or prevented emergency actions from taking place. According to Balkie *et al* (1994), many volcanic activities have demonstrated potentially conflicting scientific views as to whether or not man has an effect on the shaping of emergency responses. The difficulty in influencing public policies that overlook critical risks faced by those populations most threatened by volcanic eruptions has been underlined.

5.3.4.1 The Civil Defense Emergency Management

The Civil Defense Emergency Management Act, (CDEM Act,2002) which focuses on the '4 Rs' of reduction, readiness, response and recovery, as well as planned policy and action, was put in place as a public policy to manage eruptions in the Waikato region. According to this Act, this proved useful in managing eruptions in New Zealand. It is possible that this plan may have helped to control eruption hazards in the region to a certain extent. In neighbouring America, where there was no apparent plan in place, Marcias and Agguire (2006) note that 'the creation of a volcano disaster assistance program (VDAP) in the United States of America only followed the Armero disaster in Colombia which had already killed 20.000-24.000 people'.

5.3.4.2 The US-based Volcanic Disaster Assistance Programme

The consequences of the Armero disaster resulted in the creation of assistance programmes whose functions may be limited to a particular disaster or kept in place to manage all other subsequent ones. According to Meliti *et al* (1999), one of the consequences of the Armero disaster was the creation of the US-based Volcanic Disaster Assistance Programme (VDAP) and the United Nations Disaster Relief Organisation (UNDRO) as proposed by the United States Geological Survey (USGS). This ushered in an international emergency response called the UNDRO-USGS as an emergency management scheme. Many Latin American countries and elsewhere adopted this system. But, from the perspective of Marcias and Agguire (2006: 46), however, the scheme assumes that people are aware of volcanic hazards and wish to protect their communities in compliance with the laws on safety measures at local, regional and national levels. This scheme was found to be successful in dealing with a number of eruption hazards. For example, with the Chichonal and Nevado del Ruiz volcanic eruptions, Mexican officials adopted and applied the UNDRO-USGS with a relatively positive effect (Marcias & Agguire: 47).

5.3.4.3 The Participatory Rural Appraisal (PRA)

Following the conflicts that existed between the cultural practices and scientific views on the management of volcanic hazards, the people of Ambae (Vanuatu volcano) adopted the PRA model in an attempt to address some of the critical issues. Cronin *et al* (2004b) indicated that 'in an attempt to address the issue, rebuild dialogue and respect between communities, outside scientists and administrators, some participatory rural appraisal (PRA) approaches were adopted and applied'.

5.4   Health care and volcanic eruptions

'The community lies at the heart of public health … success with public health policies and programs depends upon the extent to which they reflect the community's values and priorities' (Citrin, 1998). It is thus clear that health care efforts should be geared at the community, with the community as key partner and participant. The models for public health care delivery differ both regarding conception and delivery. Hence, there is no perfect health care delivery system in any country. Some models seem to work better than others, but each has its own set of advantages and disadvantages (Monekosso & Martin, 2008:21).

In general, health care models could be classified under a tiered system or diffuse system (Virk, 2007). Whichever one is used, however, the aim in dealing with volcanic eruptions is to provide health care as a means of combating or addressing all volcanic-related effects on health (disease and disability control). The tiered system is made up of a regionalised system of health care delivery divided into primary, secondary and tertiary care. As far as volcanic eruptions are concerned, one would assume that all is well when implementing a good primary care system in order to control disease and disability. The primary care system could then be reinforced when the need arises by staff from a secondary or tertiary care system or both. After the tsunami of 2004 in the Indian Ocean, workers were deployed to areas affected by the tsunami for a period of two weeks after the initial disaster took place in order to provide personal support to Australians victims and their families (Manning, Saarinem & Sell, 2006). With such an arrangement, referrals are made to the secondary and tertiary levels. Therefore, at the primary level, the activities concerned with prevention and treatment of common health problems occur in an outpatient setting.

Virk (2007) is of the opinion that a primary care system could take responsibility for 2 000-3 000 patients and may be dedicated to managing a patient's overall care. During volcanic eruption disasters, for example, an increase in the number of victims requires an increase in the size of the providing team. For instance, during the Hurricane Katrina disaster, a sizable proportion of physicians remained displaced after the disaster, along with a decrease in the number of physicians serving in the areas affected by the disaster (Madamala, Nigg & Paz, 2007). Satore, et al. (2007), Naido & Will, (2000) are of the opinion that deployment should go hand in hand with programmes designed to address identified physician needs in the aftermath of the disaster to boost physician confidence. Such confidence leads to the identification of more effective health care programmes. Disaster can expose populations to several kinds of health problems (non-infectious and infectious). These health problems have been found to affect the respiratory system, skin, eyes and mental health. Metts (2008) claims that adverse health effects can be categorised as infectious, allergic or hypersensitivity reactions, or toxic-irritant reactions. All of these have implications for health care services as some may require urgent referrals.

5.4.1   Health hazards of natural disasters and quality of life

If an eminent natural disaster creates a serious risk to life, physical integrity or the health of affected individuals and communities, all appropriate measures necessary to protect those in danger, including particular vulnerable groups, should be taken as far as possible. Emergency shelter arrangements (Operational guidelines on human rights and natural disasters, 2009: 9) and evacuation measures are often critical, especially for those who cannot evacuate themselves. Such evacuations must, at all times, be carried out in a manner that fully respects the rights to the life, dignity, liberty and security of those affected. Measures should also be taken to safeguard homes and common assets left behind (ibid).

With respect to health hazards, the operational guidelines advocate the protection of victims of natural disasters against the negative impacts of natural hazards. 'Persons affected by natural disasters, displaced or not, should be protected against the dangers of potential secondary hazards'. Thus, people displaced by a disaster should, as far as possible, be provided with the means to recover as quickly as possible and become self-sustainable or by means of effective rehabilitation assistance, to return to health and safety. Camps should be seen as a last resort and should only be established where the possibility of self-sustainability or fast rehabilitation assistance does not exist (ibid: 10).

5.4.2   Health care management strategies

Models for health care management are tiered or diffused. In a diffused model, patients can approach specialists directly without consulting those at the primary or secondary levels. Whichever is used, however, the management could be philanthropic, fee-for-service (hospital paid), group service for salaries or bonuses or community health centres which are not fee-for-service (Virk, 2007). These approaches may not be used during disasters but, as observed earlier in the emergency preparedness and professional competence among health care providers during hurricanes Katrina there is no perfect health care delivery system (Slepski, 2007). It is, however, effective management and community participation that makes all the difference (Shimzu, 2001:15). Thus, management strategies during disasters must include operational guidelines on human rights and disasters; as such a guideline considers what is required for the appropriate care of victims. It further emphasises the provision of adequate food, water and sanitation, as well as shelter, clothing and essential health services. Adequacy of all goods and services implies that they are available, accessible, acceptable and adaptable, incorporating sufficient quantity and quality, without discrimination to all in need – inclusive of vulnerable and marginalised groups. Care should also be culturally appropriate and sensitive to gender and age and should be provided in flexible ways, adapting to changing needs in the different phases of emergency relief, reconstruction and, in the case of a displaced person, return.

People's behaviours have been known traditionally to be understood or tolerated by an organisation, body or policy involved in the care of people during disasters. Wilson (2008) observes that, interestingly, only a few studies follow the radical paradigm of disaster research to assess people's behaviours and risk perception in a volcanic environment. Dibben & Chester (1999) concludes that the behaviour and vulnerability of people in the face of volcanic hazards has been duly noted in the socio-economic context as demonstrated in Sao Miguel, Azores and around Mount Etna in Italy (Chester *et al,* 2002; Dibben & Chester, 1999).

5.5   Health care and volcanic eruption risks

Solving health-related issues may be difficult if separated from the perception-adjustment paradigm. However, in contrast to this paradigm, it is argued that the perception of a natural hazard and behaviour that may affect the threat it poses, is more related to social organisation and values than perceptions of the geophysical conditions, and that disasters are not explained by behaviour specific to the disaster event but rather by the nature of the society in a particular geographic location (Slepski, 2007, Queseda, 2005: 3, Hewitt, 1983; Susman, O'Keefe & Wisner, 1983). Within the health care context, knowledge of the risk is considered a factor in planning for the health care needed. Many studies have shown that volcanic risk perception is primarily shaped by hazard knowledge, which largely depends on previous experience of volcanic eruption, and/or by information provided by different media (Davis *et al,* 2005; Finnis, Johnson & Paton*,* 2004; Becker *et al,* 2001). These usually provide the health sector with information on what is acceptable and what will be utilised. Gregg *et al* (2004a) also linked good hazard knowledge and risk perception to eruption experience and repose time, all of which contribute to the utilisation of health services or health care.

Evacuation is a strategy that is usually readily accepted by the health sector. Evacuation plans for those residing on or close to volcanoes, rather than permanently migrating or being removed during periods of crisis, are a common feature of many societies' adaptation to volcanic risks (Wilson, 2008). It must be noted that evacuation may prove problematic, particularly in the absence of a well-thought-out plan and in the case of mass numbers having to be evacuated. Evacuation plans may facilitate the process. For instance, the Italia experience was interesting given the large numbers of people and the

way in which the National Emergency Plan for the Vesuvian Area (NEPVA) of 1995 was prepared to meet the goals (ibid: 165). It is also worth noting that most often the people to be evacuated are unaware of the evacuation plan. People may have a realistic view of the hazard they are exposed to, but they do not necessarily have a clear understanding of the evacuation plan itself or they may lack confidence in the officials (Barberi, 2008). The author suggests that encouraging residents to be more involved in planning for an evacuation may prove helpful in bringing about greater understanding and confidence in any plan.

This, of course, ties in with the need for well-developed educational programmes to enhance knowledge and confidence. Educational programmes are important in creating an understanding of the imbedded risks and the importance of quality health care services. Green *et al* (1990) stress the role of the media in determining risk perception. Notwithstanding, sometimes health education does not necessarily yield positive results. For instance, Dominey-Howes & Minos-Minopoulous (2004) note, for unclear reasons, a lack of understanding of volcanic hazards on the island of Santorini despite vigorous educational programmes.

Leonard, Johnson, Pato, Becker & Keys, (2008) identify another type of evacuation context, which is the tourist ski complex on the slopes of Ruapehu volcano, New Zealand, but observed that it was difficult to work in a transitory community. This requires the involvement of the tourist officials. The authors note that a great deal of responsibility for successful evacuation lies with the staff of the tourist facility. They also bring our attention to the fact that the perception of the level of risk may be accurate, though it does not necessarily lead to effective behaviour. They also propose a five-step model for an effective warning system.

Health education and information campaigns may raise people's awareness with regard to the risk and hazards and help to reduce their vulnerability in the face of volcanic hazards (Carlino, Coleman, & Stockman, 2008; Solana *et al,* 2008). However, Haynes *et al* (2008), Perry & Lindell (2008) and Paton *et al* (2008) warn that there is no simple relationship between information and behaviour. Any educational programme must take into account a range of complex social processes (Wilson, 2008).

In terms of policy and/or community matters, authorities need to participate fully in the communities to understand the interplay of factors that may aid any policy planning and/or process. Wilson (2008) insists that, in order for the authorities to fully appraise the local context of volcanic risk, local authorities have to work in close collaboration with local communities. This will assist them in defining people's risk perceptions, as well as the weight of structural constraints such as livelihood alternatives or cultural attachment to their place of residence. Such collaboration may contribute to overcoming differences or contradictions between people's behaviour and the policies of the authorities (Barberi *et al,* 2008; Kelman & Mather, 2008; Paton, Smith, Doly & Johnson*,* 2008).

Over the years, many factors have been identified regarding the implications of policies on health hazards, health organisation, health stance but learning from others is trustworthy (Pelling, 2007). The continuous identification of such issues has provided the impetus for a reappraisal of the agenda for reducing disaster risk/hazards associated with volcanic hazards which is still basically hazard-focused (Chester, 2005). Thus, an example such as the Hyogo framework for action could be put forward for consideration.

5.5.1   The Hyogo Framework for Action (HFA)

This framework provided an important plan of action in bringing about the reduction of disaster impacts. It was named the Hyogo Framework for Action (HFA) 2005-2015, as agreed upon by representatives of 168 countries who participated in the World Conference on Disaster Reduction, held in Kobe, Hyogo, Japan, in January 2005 (United Nations International Strategy for Disaster Reduction, 2005). The HFA stresses the importance of making the reduction of disaster risk a priority. It underlines knowledge of the risk in a holistic manner rather than focusing on the hazards-related

dimension only and promotes an early warning system. It includes the building of understanding and awareness using local and scientific knowledge in addition to working towards the reduction of underlying, hazards-independent factors of risk. It moves for a strengthening of disaster preparedness for effective response at all levels (Wilson, 2008:167).

Wilson (2008: 165), continues that the ten-year agenda for disaster risk reduction involves blending both hazard-related and non hazard-related measures. It set the threat from disaster beyond the sole dimension of natural hazards and locates it clearly within people's vulnerability in the face of nature's threat. It recommends culturally sensitive mitigation measures that consider the cultural, social, economic and political context. The HFA further emphasises the importance of people's livelihoods and asserts that natural hazards cannot be prevented, though it is possible to minimise their impacts by reducing the vulnerability of people and their livelihoods (United Nations International Strategy for Disaster Reduction, 2005: 4).

5.6   Cultural practices and the role of health care services

The idea that differences in risk perception might naturally arise from society has been central to the cultural theoretical approach to risk perception (Thompson, 1980; Douglas, 1966). It has been said that risk selection is based on cultural biases or deeply-held beliefs and world views, the value of which lies in the defence of particular social relations. Consequently, four main archetypes can be identified: egalitarians, individualists, hierarchists and fatalists (Douglas & Wildavsky, 1983). Generally, members of social organisations and groups will affect the risk identified by individuals, as well as the way in which these are integrated into existing patterns of belief (Green *et al,* 1990). It should also be taken into account that close adherence to local customs and beliefs may pose problems to or promote assistance programmes. Such realities cannot be ignored as they can either prevent or create a barrier to emergency actions. Various scenarios of cultural practices have been found to increase or assist in decreasing the effects of volcanic hazards around the world. The effects of cultural biases on perceptions of risk will be felt strongly when any 'objective assessment' of risk is very difficult or impossible (Adams, 1995) or when people are especially likely to impose meaning onto the realities of uncertainty (Wilson, 2008).

It must be noted that volcanic eruptions and the hazards they pose in relation to society have physical, psychological and social implications in terms of risk assessment and risk management (Madamala, Nigg & Paz, 2007:13). Why some risks are given more attention than others because they are physical could overshadow psychological hazards that may be long term and so are not considered as very important. This has been seen in the risk amplification theory where all kinds of risk must be considered as soon as volcanic risk and other disasters are concerned (Kasperson *et al,* 1988; Kasperson, 1992). Therefore, the assumption that most of the information people receive on risk is achieved through communication rather than direct experience, explains how various psychological, social and cultural factors lead to the perception of risk being either attenuated or intensified (Wilson, 2008). Consequently, this leads to groups and individuals having various interpretations of hazard events (Kasperson et al, 2003).

In terms of emergency plans, the individual must be aware of a hazard in order to initiate the process of decision-making (Wilson, 2008). Given the fact that people have different thresholds regarding when they become aware of a hazard, various levels of behavioural adjustment or adaptation to risk behaviour occurs (Burton *et al,* 1993). The presence of a perception-adjustment paradigm exists where an individual appraises the probability and magnitude of extreme events, canvasses the range of possible alternative actions, evaluates the consequences of selected actions and chooses one or a combination of actions (ibid).

5.6.1 Cultural reality and the role of cultural beliefs against adversity and fear

The preservation of one's livelihood is often considered to be the most important factor in life. This has been demonstrated by Kelma & Mather (2008), Dove (2008), Lavigne *et al* (2008) Haynes (2008) and Guillard (2008), all of whom agree that the need to preserve one's livelihood is often an early determinant of a person's behaviour in the face of volcanic hazards. Livelihood is then linked to a range of behaviours that follow suit, even in the face of eminent evacuation. These realities have been found to be directly or indirectly linked with an acceptance to evacuate, as cultural familiarities with the environment would be lost. According to Schlehe (1996) and Dove (2008), the inhabitants of the Merapi region prefer to live on the slopes of an active volcano for

they claim to have a cultural familiarity with the place and a set of coping mechanisms inherited from their ancestors.

Socio-economic factors are linked to cultural beliefs. These have been observed on Mount Popocatepetl in Mexico, where Medrano (2005) demonstrated how risk around the mountain was linked to socio-economic and political forces. Anthropologists showed how traditional societies share a strong bond with the volcano near which they live and draw attention to their biased perception of associated risk. For example, Mount Rabaul, in New Guinea, is the focus of Tobai's life (Waninara, 2000). Mount Pinatubo also plays a central role in the cultural life of the Actas of the Philippines (Gaillard, 2006; Tima, 2005; Seitz, 2004; Shimizu, 2001, 1989).

'Intimacy' with volcanoes has also been recorded in Tonga and Hawaii. The people of Niuafo'ou (Tonga) and Hawaii nurture intimate relationships with 'their' respective volcanoes (Queseda, 2005, 2007). Sometimes, other factors combine with the perception of the hazard or act independently to shape behaviour in the face of the volcanic hazard. These factors are cultural, social, economic and political in nature. They are independent of the volcanic threats and act as powerful constraints to people's decision-making and capacity to protect themselves (Chester *et al,* 2008; Dibben, 2008; Dove, 2008; Guillard, 2008; Haynes *et al,* 2008; Kelman & Mather, 2008; Lavigne *et al,* 2008).

5.6.2 Religion and spirituality in natural disasters

Religion has a tremendous influence on one's perception of a disaster and the measures one takes in order to protect oneself or a group. Chester (2005) and Bankoff (2004) focus on the influence of religion on people's behaviour, risk perceptions and actions taken. They have demonstrated how religion continues to influence people's perceptions and responses to volcanic hazards – not only within traditional communities but also within Christian societies. Religion and volcanic risk perception have been explored in terms of the relationship between volcanic risk perception and actions (Chester *et al,* 2008; Gregg *et al,* 2008). As Gregg *et al* studied the traditional Hawaiian beliefs and religion, Chester *et al* focused on Southern Italy. In both cases, the influence of a god was observed. Gregg *et al* (2008) found a complex set of reactions to various

volcanic mitigation measures around Kilauea, but discovered a strong negative reaction to bombing among those expressing a belief in the volcano goddess, Pele.

Cheater *et al* (2008) argue that the importance of contemporary religious beliefs in understanding people's behaviour in volcanic environments may be hidden by both the researchers' post enlightenment theoretical stance, but also to the unease some respondents may have in expressing complex religious responses to volcanic risk to researchers. In another sense, Wilson (2008) ascertains that when people's beliefs are revealed through careful research, the religion is still found to be important. Lavigne *et al* (2008) found that, in central Java, Indonesia, behaviour that increases volcanic risk was closely intertwined with the religious and cultural traditions of the area. Another significant finding was that poverty itself was seen to be driving individuals to exploit ostensibly hazardous areas of the volcano. These actions, however, generated a different set of risks to those that appeared to be emerging from people's everyday struggles to preserve their livelihood.

5.6.3   Interface between traditional and modern science

An interface between traditional cultural practices and modern science can be perceived and/or observed only from other studies. People living under volcanic threat actually consider the benefits associated with more risky behaviour and this in turn influences the conceptualisation of risk (Wilson, 2008). Paton *et al* (2008) observed the problem of trying to increase a population's level of preparedness. They argue that, rather than being strongly related to the experience of volcanic activity, a population's intension to prepare is, in fact, influenced by social processes – the belief in the benefits of mitigation, community involvement and trust in institutions. Adjustment to hazards may be influenced by traditional cultural practices or modern science or a combination of both. These have been found to rotate around a sense of responsibility, creating an interface between the options. Perry & Lindell (2008) explored people's self-protection strategies to some hazards including volcanic hazards in Californian communities.

Tension and uneasy relationships have also been observed in many volcanic contexts, the simplest of which was found to exist between science, politics and health sciences. In the midst of such tension, information may assume different forms. Haynes *et al* (2008) investigated the way in which risk information assumed different forms and

meanings as produced and reproduced by different groups on the Caribbean Island of Montserrat. They identified a tension between local politicians who were trying to avoid being seen to make unpopular decisions and scientists who were trying to resist being drawn into making decisions rather than simply providing a neutral scientific-based prediction of risks.

Scientific views have also been found to differ, meet and interface before reaching conclusions. For instance, there have been arguments on the view that it is inappropriate to consider the 'volcanic' aspects of volcanic-human interactions as always or largely negative by some authors in volcanology, the health and social sciences. Dove (2008) and Kelman & Mather (2008) have pointed out that this may not be the most appropriate starting point for research, but that it is one that is encouraged by a particular institutional position.

5.7   Community health models

In reflecting on models for health hazards of volcanic origin, it is meaningful to reflect on existing frameworks. Kelman & Mather (2008) insist that existing management frameworks can be applied to volcanic environments – more specifically, a sustainable livelihood approach could be used as an organising principle. In the development of any model, it must be remembered also that in many circumstances there might not be a causal relationship between risk perceptions, healthy relationships and behaviour. Rather, behaviour could, or would be constrained by social structure and health care requirements. Therefore, in order to establish risk perception and health planning, it is necessary to understand the wider social context in which individuals are situated (Wilson, 2008). This requires that information be gathered from a range of sources.

Community health models usually take a range of sources into consideration, using triangulation as a critical element in the practice of social science (Flick, 1998: 178). The triangulation of data is meant to add one layer of data to another to obtain quality information. In order to come up with a highly beneficial community health model, one may be required to consider the framework created by Annis & Racher (2005). Ryan, Nicholas & Racher (2004) define community health as 'the ability of a community to generate and effectively use assets and resources to support the well-being and quality

of life of the residents of the community as a whole.' The model therefore should demonstrate the ability to merge the community development process with compatible community assessment, planning, implementation and evaluation (Annis & Racher, 2005).

According to Burton *et al* (1993), an individual must be aware of a hazard before he or she can begin the process of decision making. Risk behaviour varies, and therefore decision-making also varies. In using such a model, it should be noted that different people have different thresholds concerning the point at which they become aware of a hazard. Therefore, they will take decisions (actions) at different times and levels.

Models in the nursing domain that address care needs of communities and which incorporate risk/hazard perception are important. Carlino *et al* (2008) have shown that, in some cases, these may be significant factors in explaining people's behaviour. Thus, if risk/hazard perception is not connected overtly to people's behaviour, it may be the individual's or the community's experience of the previous eruption that will prove to be critical in shaping adjustments to the threat (Perry & Lindell, 2008).

5.7.1   Collaborative model for community health action

The collaborative model is an important framework that requires little interpretation for application in any community health setting. According to Annis & Racher (2005), this community health action model is unique in its ability to merge the community developmental process with a compatible community assessment, planning, implementation and evaluation framework as the community takes ownership, gives direction and assumes responsibility for activities and outcomes – for doing the right things in the right way.

5.7.1.1 Key concepts in the model

The model recognises the fact that the community, community health, community development, community resiliency and community participation must interrelate. Thus, Annis & Racher (2005) make use of definitions by a range of authors to address these concepts:

- 'Community can only exist when a group of people, whether defined by geography or affinity, engage in social interactions, builds ties, exhibits

awareness of identity as a group, and holds direct access to collective decision making' (Hancock, Labonte & Edwards, 1999).

- 'Community health is the ability of a community to generate and effectively use assets and resources to support the well-being and quality of life of the residents of the community as a whole, in the face of challenges and barriers within the context of their environment' (Ryan, Nicholas & Racher, 2004).

- 'Community development and community health promotion are synonymous; a philosophy, a process, a project and an outcome' (English, 2000).

- 'Community resiliency is the ability of a community to respond to adversity and in so doing to reach a higher level of functioning or to extend community capacity' (Kulig, 2000).

- 'Participatory action research relates to when community members participate in gathering information – they partake, linking scientific inquiry with community development and change, blending research with education and political action' (Dickson, 2000).

5.7.1.2 Description of the community action model

The model is built on a step-by-step basis beginning with the core concept of being. It is stated that, in this being, there is interaction as a collective unit. The being is followed by the 'basis' of every community that includes, for example, population and health; social support and community processes; recreation, heritage, arts, safety and security; community infrastructure and environment; economics and education. The next step is that of belonging, which includes all of the above, as well as an expression of being a community. This is followed by adding the concept of becoming. When taking up 'becoming', community action is eminent. The image now is one of a bottle with a neck (Anis & Racher, 2005).

5.7.1.3 Genesis and usefulness of the model

The model could not have been developed without input from the community, since, in order to qualify as a community health model, input from the community is considered to be a crucial component. Thus, according to the authors, rural residents contributed to model development. This included contributions in focus groups, workshops, pilot testing with rural communities, and pilot testing in northern Manitoba. This was also

supported by theoretical contributions from the literature, including a health promotion model, a revised community resiliency model and a community-as-partner model (Annis & Racher, 2005).

The model targets two categories of users, i.e. the community and the researcher. For the community member, it aids thinking not only about what he/she is doing, but also how and why. It aids the process of focusing on issues within the larger community context, aiding strategising and determining goals specific to the community. It identifies those who need to be involved, those who are already at the table and those who need to be invited. The model fosters the development of a plan, timeline and resultant action, inclusive of monitoring. At its core, it focuses on community health and well-being as the centre of the dialogue and all imbedded actions.

Researchers are being encouraged not only to focus on what is done, but also on how it is done, as well as on placing the community at the centre of the dialogue, setting goals and taking actions. The larger community context and framework become important and facilitates creative reflection in terms of being proactive rather than reactive in community health promotion activities. It is also said to support the integration of assessment of impact in the areas of research, practice and policy (Annis and Racher, 2005).

5.7.2   Decision-making model

Another model within the risk perception model is the so-called decision-making model. As early as 1980, nursing theorists have identified decision-making as related to critical thinking and problem solving. The decision-making model in health care is used for deciding on a particular course of action by the health provider and the consumer (Murray, 1980). The model is divided into the phases of deliberation, judgment and choice. During deliberation, one searches for conditions that call for action and alternative actions. In the judgment phase, one analyses each alternative and its consequences. Finally, during decision-making, one alternative and its related consequences are selected as the course of action.

5.7.3   Model for early warning systems in volcanic risk zones

In an attempt to manage health hazards related to volcanic eruptions, the phrase 'early warning system' often appears in literature. Any effective early warning system must be

underpinned by well-established natural and hazard event research (identifying the source and nature of the lahar risk in a specific area), as well as impact research (for example, hazard maps and vulnerability research (Leonard *et al,* 2008: 205). Leonard identifies five components of an effective early warning system. These include an appraisal of the nature of the early warning system (hardware, electronics and planning necessary to effectively detect a hazard); planning (decision-making tools, e.g. thresholds, evacuation routes and maps); co-operation, discussion and communication (pre-planned and exercised communication between central government agencies, local emergency management agency staff, scientists, media, community representatives, etc.); education and participation (public education, staff training, maps and signs all designed within the community); and exercises (scenario development and simulations, observation and feedback (Leonard et al.: 2004: 205).

Early warning research has emphasised increasingly the need for 'people-centered warning systems (Basher, 2006; Gurstein, 2005). Basher promotes an integrated (non-linear) system model of early warning systems. Leonard *et al* (2008) puts forward a practical five-step process for the development of effective early warning systems with an integrated theoretical systems model. The system 'places a heavy emphasis on social relationship factors (integrating technical requirements with co-operation and communication rather than the communication hardware alone), participation, education, exercise and evaluation' (p. 203). The steps included are an effective warning system planning, discussion, communication and participation, education and engagement, exercise and blind testing and, lastly, effective evaluation (Leonard *et al,* 2008: 203-207).

5.7.4   Adaptation models for community health hazards

Adaptation is a concept used traditionally to describe the process by which an organism responds to its environment and includes all conscious and unconscious forms of adjustments. These adjustments are, of course, required in the midst of any form of health hazards. Definitions of the concept of adaptation usually include change, response and environment. Adaptability is not simply an inherited, individual or community quality, it is also a social one. It is made necessary by the expectations and restrictions society imposes on itself and its individuals (Murray, 1980). Adaptation has been defined as:

the process of change whereby the individual retains his integrity – his wholeness – within the realities of his environment. A truly integrating system within the organism must be one that responds to environmental change, yet in the process defends the wholeness of the individual. The purpose of integration is to establish order and organisation within the organism in harmony with its external environment (Levine, 1969: 69).

The concept 'organism' could be interpreted as an individual, group and or community.

Adaptation and adjustments are, for example, used when there is stress in the form of a hazard, risk or threat. These cause imbalances in normal existence, inherently related to the stages of adaptation (Roy, 1976). A model of community health care that sets out to guide the management of collective threats, risks, hazards and other stressors can make good use of Roy's model of adaptation. In Roy's somewhat older model, the goal of nursing is to help the client (individual or community) adapt to situations of health and illness. The model deals with people as biophysical beings in constant interaction with a changing environment (eruption environments inclusive).

5.7.5   Models for health promotion

There are various approaches to and models developed that incorporate health promotion (Walsh, 2005). Naidoo & Wills (2000) stated that the preventive approach seeks to increase medical interventions that will prevent illness. The orientation is medical and uses epidemiological methods and screening techniques. It moves from the premise that the prevention or early detection of disease is much more affordable than treatment of the established disease later. Success stories based on the use of the model have been recorded in the elimination of some communicable diseases by vaccination, for example, smallpox and poliomyelitis.

The behavioural change model is popular with government publicity campaigns and is aimed at persuading people to change their behaviour. The approach is said to be expert-led and targeted at individuals. On the other hand, the educational model does not directly set out to persuade people to change their behaviour, but to provide knowledge and information in the hope that the person will subsequently modify their behaviour as a result of their own choice. According to Walsh (2005), both the

educational and behavioural change models suffer from disadvantages, as human health behaviour is far more complex than is acknowledged. The individual may, for example, not have the necessary resources to make individual lifestyle changes, even if they wanted to.

The empowerment model, which has been said to apply a bottom-up approach, involves helping people, either as individuals or in communities to decide for themselves what health-promoting activity they wish to participate in and to act for themselves (Wilson, 2008:3). The social change model has been described as somewhat radical, as it aims to change the physical, social and economic environment as a means of achieving healthier lives for people (Kelman & Mather, 2008:190). In all of these models, there is a message that directs the development of other models. Thus these messages and the results of this research have jointly informed the adaptable model for the Bakingili community and its environs.

5.8. Conclusion

In the process of producing an adaptable model, inputs from all the models discussed in this research and the data collection from all the sources were used. It is believed that every model has important components, uses, phases, and reason for its existence. The following aspects were considered important:

- The *community health action model* of Anis & Racher (2005) identifies three key aspects of community, namely being, becoming and belonging. These three aspects would meaningfully relate to community **participation** and of taking responsibility. The model also targets two categories of **users,** namely community and health workers.
- The *decision-making model* introduces the importance of **phases** within the processes of model-deliberation, judgement and choice (Murray, 1980).
- There is the **nature of perceived danger** as postulated in the *early warning system model* (Leonard et al. 2008)
- **Methods of adaptation** to the required needs are emphasized in *the adaptation model* (Webber & Ison, 2000; Murray, 1980; Roy, 1976; Levine, 1969)
- The importance of health promotion is underlined in the *health promotion model* (Walsh, 2005; Naido & Wills, 2000).

CHAPTER SIX
TRIANGULATION AND MODELLING

6.1   Introduction

The use of primary data and secondary data in research is possible, particularly where triangulation is to be used. In addition, various methods of data collection offer a range of advantages and disadvantages. It thus makes sense for researchers to use different methods as it may counter-balance weaknesses in one method and provide a more rounded picture of the phenomenon studies, especially in complex research areas such as community health. Triangulation also provides the vehicle to compare and contrast a range of data sets and strengthen the trustworthiness of a set of complex findings. When results, obtained through various methods of research, are triangulated, the data could be used to construct a model fit for a unique context or situation.

Researchers have developed models for use in planning, implementing and evaluating health actions. Examples include the social model approach (Priestley and Hemingway, 2006) in the disability and disaster recovery process; the Participatory Rural Appraisal approaches in the Ambae region (Cronin *et al*, 2004b109); and the Protective Action Decision Model (Lindell & Hwang, 2008:540). Often, the model takes into consideration data from various sources, using triangulation as a critical element in the process of model construction – adding one layer of data to another to build a confirmatory edifice (Flick, 1998: 178).

Fairness has been thought to be a quality of balance, that is, to include all stakeholders' views, perspectives, claims, concerns and voices (Flick *et al*, 2004: 278). Similarly, truth has been described as the end process of rational processes, as a result of experiential sensing, or empirical observation (Flick et al.: 271). These two critical and sensitive aspects of social research are often confirmed by the triangulation of data from various methods.

Themes generated from focus group discussions with community members at risk, but who have experienced such a volcanic eruption, as well as with front-line workers, such as nurses, and documented evidence were included in the triangulation process. Identified themes included the nature of the hazard, management strategies (prevention and mitigation), local views and perceptions, perceived adequate approaches, difficulties and challenges, adherence to local customs, the acceptance of outside knowledge and solutions, gender issues, the causes of resistance and co-operation, information flow, and more. These were presented in the form of frames and tables in order to create a clear depiction of those areas showing an overlap of ideas and also as a means of highlighting areas of difference, as well as showing conclusions and actions taken. Specifically, the frequency of occurrence of themes and description of such themes with literature has been used in line with Rubin & Rubin, 1995. Numbers in qualitative have known to add rigor in the data (Doucet & Jehn, 1997:540). These two sources informed the use of numbers attached to utterances and occurrences as the method of data analysis.

6.2   Triangulation

An understanding of perceived hazards and ways of dealing with such hazards from the perspective of both community members and health care workers (nurses and nurse aids) form a critical basis for a meaningful and adaptable model. The exposure of the members of these two groups to a similar environmental hazard, was believed to have informed their understanding and management of such a hazard should such a hazard occur in future. Within this study, understanding was further enriched through the analysis of documentary evidence, as well as the detailed examination of existing literature on the subject presented in the literature review. The main tenets of the said data as compared are represented in Table 6.1.

Table 6.1   Meaning, management and what matters most

Data sources	Meaning ascribed	Management strategies	What matters most
Focus groups: Community members	Intimate sacred relationship

Knows mountain best and feels it first | Appease and/or approach Stay at home or outside of home (protect belongings) | Need to stay (evacuation a concern, relocation not an option)

Hold on to livelihood (rich soil, tourists) |
| | Harms health and infrastructure | Look, listen and learn (alert)

Protect body (oils and masks) | Improve health care services

Locate missing persons

Provide quality education

Provide protective devices |
| | Conflict: Science versus cultural practices | Respect local chief, local council

Acknowledge government support and international aid

Media (radio) | Explain value of monitoring

Be involved in planning

Feedback |
| **Focus group: Health care workers** | Make scientific references

Value rich soil | Value professional knowledge and status

Advocate health education

Value role in community | Consider opposing cultural beliefs disconcerting

Stress importance of livelihood

Respect of community |
| | Threat to community (health, air, water resources)

Bring change to work responsibilities | Request relief teams

Request supplies

Help with logistics | Is concerned about:

Cooperation with other health carers (referral centres)

Lack of supplies, equipment |
| | Heightened alert, vigilance and commitment | Mobilise help

Work hard and continuously | Enhance:

Communication

Joint decision making

Support |
| **Docu-** | Community intimacy | Collaboration | Acknowledge and accept |

Data sources	Meaning ascribed	Management strategies	What matters most
mentary evidence	with volcanoes	Sensitisation and awareness	being prone = reality Communication Public and civil organisational involvement
	Cultural, social and mental health realities	Comprehensive directive frameworks (including human rights and mental health) Involve all role-players	Incorporate critical aspects (preparedness, monitoring, mitigation, emergency response, etc.) Scientists, government, health services, community members
	Value realities of community health care	Strategies to foster understanding, acceptance, protection Understand context	Equal footing Dialogue Collaborative planning
Literature review	Range of disasters, complex challenges	Scientific knowledge (holistic research)	Context Severity
	Developmental, empowering focus	Holistic model application (collaborative, adaptive, decision-making) Risk-management strategies	Community sense, e.g. being, belonging, becoming Education (including sensitisation, awareness) Perceptions of risk
	Public health care reality	Multiple scientists, health care professionals, government	Community-based, collective approach Health care promotion

From the above, it is clear that similarities and differences exist between the four sources of data, but that some critical elements are present within or relevant to the context of Mount Cameroon and its potential in terms of further volcanic eruptions:

- The need to focus on the critical, but complex relationship with the mountain –

acknowledging and collectively dealing with religious and cultural practices, came to the fore.

- Involvement and recognition of community members as critical role-players in the management of such natural disasters (including government, health services, the local chief and council) were mentioned. It becomes unnecessary to include structures that users are unaware of, except in the context where mitigation takes a top-down approach as is apparent in the findings of this study. However, Leiby (2008) advocates learning from the experiences of respondents to recent national and international relief efforts to ensure the organisational and personal preparedness in dealing with the complex ethical, moral, legal and medical issues during a disaster.

- The upliftment and enhancement of health care services within the area, implementing a holistic public health care framework were mentioned. More often than not, government publications with regard to risks are not likely to be understood by those at risk (Lave & Lave, 1991).

- Further development of the skills, knowledge and support systems of health care workers, in this case, nurses practicing in the area came to the fore. In all instances, disaster planners must plan for health care worker-related issues as well, such as transportation and communication (Chokshi *et al*, 2008). The health workers in this study (nurses) have shown that they are not fully prepared and may even require further education. In a model for health care workers, the epidemiological model in combination with the nursing process will probably facilitate professional development.

- Addressing the somewhat complex nature of directives at both national and regional level to enhance easy activation and implementation was mentioned as critical. Thus, as stated in the collaborative model for community health action (Annis & Racher, 2005), it is important to develop a community spirit of being, followed by belonging, and, finally, of becoming active participants in the community assessment, planning, implementation and evaluation of its very real problems and solutions. Therefore, the ability to recognise the risk, communicate with others and obtain information, participate in preparedness routines, mobilise actors in prevention, mitigation and management, cooperate with various institutions, individuals and organisations, utilise and support local

health care providers.

To summarise, Figure 6.1 depicts the major areas of importance in terms of developing an adaptable model for the community that may face possible further volcanic eruptions from Mount Cameroon, zooming in on religious and cultural practices (the mountain being a chariot of god that needs to be appeased and closely monitored by men and elders), the collaboration of community members (before, during and after such volcanic outbursts, as well as related to collaborative health care planning and management initiatives), the alignment of directives and structures (at local, national and international level), role-player involvement (including scientists, aid organisations, government and other structures), and the re-alignment of health care services (infrastructure, systems, processes and health care providers).
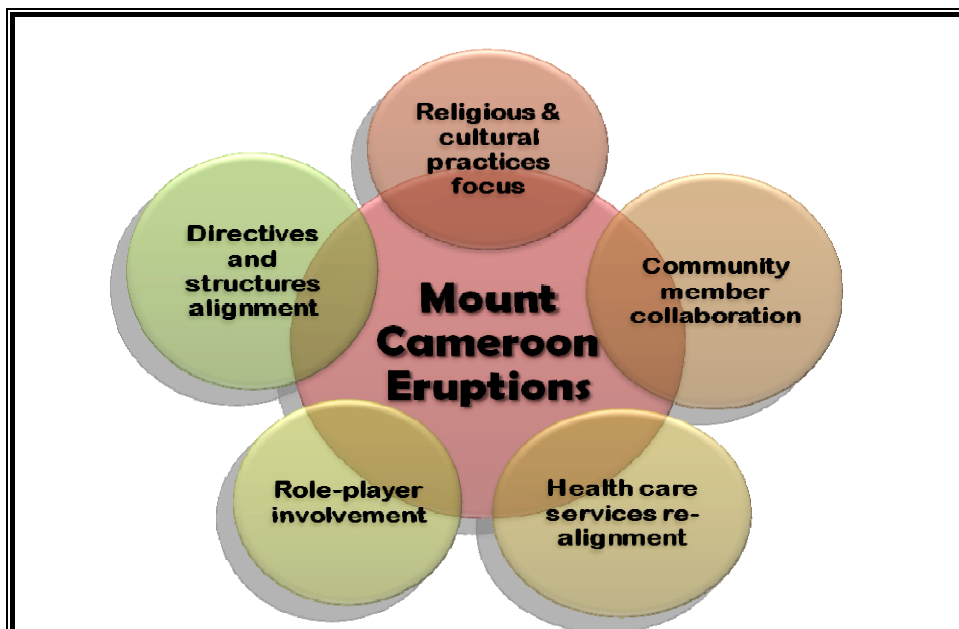
Figure 6.1: Major areas of importance in developing an adaptable model for the communities within reach of the Mount Cameroon eruptions

The major areas of the adaptable model have been deduced from the data collected in this research study:

- It was clear from the data that Mount Cameroon eruptions hazards are real and need to be managed in an adaptable manner. Community members experience tremors and irritations during the explosions when the mountain erupts. There is a constant threat of a natural disaster in Cameroon, particularly in the chain of active volcanoes that stretch from Mount Cameroon in the south-west to the

Kapsiki massif in the northern region of the country (UNDP, 2005).

- Religious and cultural practices may interfere with health actions, but could be managed by a health service that is informed and sensitive to such practices. The study participants indicated the influence of such practices in moments of volcanic eruptions and evacuation. This has also been the case in other studies where the influence of religion was documented as having an affect on people's perceptions and behaviours towards volcanic hazards (Chester, 2005; Bankoff 2004).

- Inherent in the nature of communities such as Bakingili is collaboration. An adaptable model would be welcomed. This includes communication of the eruption event to others, working with the health care provider and agreeing on roles and responsibilities of the community and government. Participation in this way assists a community in combining efforts towards self-help and health promotion. This approach was also found to be effective in other similar situations (Bar-On & Prinsen, 1999)

- The health care service requires realignment, and community members often look up to the providers for leadership and support. The need for first - aid health education has been indicated by the health workers of this study. Health education would reduce the risk of disease and illness, for example inhaling the particles of eruption, the acceptance of evacuation and other health options (Babu, Chotray, Haza & Satyanarayana, 2001: 9).

- All the different actors are important and considered critical role-players in managing Cameroon eruption hazards. The community members and health workers of this study highlighted such actors to be researchers, scientists, tourists, the deployed health workers (doctors, nurses, drivers etc) and the community members themselves. Members of rescue teams are often from varied backgrounds and different countries, all aiming at rescuing any one at risk. Collaboration among these actors is considered very necessary to manage such natural risks (Gregg *et al.* 2004b)

- Directives and structures at various levels need to be aligned for use by all community members. The participants here identified a lack of health infrastructure and the need for sound health protection practices, for example to be able to cover their noses and particularly nostrils during eruptions.

Madamala, et al. (2007:14) suggested directives that are easy to follow (understood by community members) in developing practical management plans of natural disasters.

The adaptable model as developed considers the critical elements of providing quality community health care to the communities at risk – valuing the community members as important role players to deal with such difficult natural phenomena.

- End of Chapter 6 -

CHAPTER SEVEN
DISCUSSION, CONCLUSION AND RECOMMENDATIONS

7.1   Introduction

The very recent volcanic eruption in Iceland and its effect on most European countries, as well as on the United Kingdom, has proven the current relevance of this study. While air transportation has been disrupted severely, the media has been out in full force with the aim of informing and warning the public. This research study, however, focused on developing an adaptable community health model for the management of health hazards related to the volcanic eruptions of Mount Cameroon. It used a qualitative data collection and analysis process to produce a model for the community and involved role-players, especially health carers and nurses as frontline staff. The health carers include nurse aids. Within this study, data collection focused primarily on focus group discussions with community members and with health care workers (nurses). Both groups have either directly encountered such an experience or were involved to some extent, and were thus able to provide rich and informed data. Their views on the phenomenon, now referred to as meaning and management strategies, were presented and related to those aspects that matter most (referred to as 'what matters most') within and surrounding such an event. These included matters such as cooperation and resistance. These two sets of data related to the achievement of objectives one and two.

An analysis of documented evidence from local resources focused on the realities of such a hazard, prevention and mitigation measures, and adaptable methods that could be used to inform the model. This data related to the achievement of objective three of the study. As earlier stated, the data collection was conducted according to a three-staged strategy: Local documents from the local research institutes were used, the reports of local commissions and committees were explored and the ministerial departments and local health documents were reviewed. The exploration of international relevant strategies in managing natural disasters in general, and volcanic disasters in particular, focused on the achievement of Objective 4 of the study. A literature review was also undertaken as a means of enhancing further understanding before the methodological and data triangulation was performed to aid the development of an adaptable community health model. This related to Objectives 5 and 6 of this study.

7.2   Nature of the phenomenon

The discussion focused on Mount Cameroon as a phenomenon and other similar sources of major health hazards within Africa and the world. Results indicate that the people of this area view the mountain as a god, although the health workers see the mountain as a cone of chemicals capable of erupting. Scientific documents of the area describe the mountain as a stratovolcano of the strombolian shield type that erupts from time to time. There is a constant threat of natural disasters in Cameroon, particularly in the form of a chain of presently active volcanoes that stretches from Mount Cameroon in the south-west, to the Kapsiki massif in the northern region of the country (United Nations Development Fund, 2005).

Other African volcanoes were found to be in a similar state. Internationally, eruptions were also found to be relatively common. The hazards associated with Mount Cameroon are similar to other worldwide hazards. It was deduced from the focus group discussions that communities are aware of such hazards as ash inhalation, panic and skin irritations. Health workers mentioned hazards such as eye and respiratory contamination and infection. Local medical records described the hazards as having caused skin, eye and respiratory health care problems and were found to have been among health care matters with the highest report rate during consultation during the 1999-2000 eruptions of Mount Cameroon (Afane *et al*, 2001, 2000). According to African literature, these eruptions have been responsible for the death of many, while international sources confirm that the eruptions are hazardous and potentially deadly.

Volcanoes have been found to provide fertile soil for agriculture, impressive tourist sites, mineral wealth and hydrothermal power among others, despite their imbedded hazards and risks. The risks and hazards are usually considered by community members in relation to other values (Gregg *et al*, 2008).

7.3   Management strategies

'Sub-Saharan Africa is home to extra-ordinarily vigorous peoples who have fought and survived the earth's most biologically hazardous environments' (Monekosso and Martin, 2008: 27). When viewed in relation to such a potentially hazardous situation,

the local community can be described as being more reactive (e.g. when tremors are felt or lava is seen to be flowing), while the government undertakes the process of monitoring the activities of the mountain from its Ekona seismographic centre. Elsewhere in Africa, monitoring is the main preventive approach carried out by different departments (meteorological, geographical, geological or volcanological).

A range of actors, which vary from country to country, are involved, ranging from or including volcanologists, geologists, the military, regional administration, telecommunication and health and social workers. Within Africa, management involves communication (though not emphasised as such), monitoring and degassing. In general, several ministerial departments are implicated in the management of disasters in Cameroon. These include, for example, Ministries of Mines, Water and Energy, Scientific Research, Territorial Administration, Public Health, and the Secretary of State for Internal Security. A national observatory was set up to integrate an early warning system and an emergency telecommunication system as part of the Civil Protection Arm (Civil Protection, 2006). Emergency services are managed by range of ministerial departments that include the Prime Minister's Office, Ministry of Territorial Administration and Decentralisation, Ministry of Posts and Telecommunication, Ministry of Public Health, and the Ministry of Defence. In an effort to consolidate such widely dispersed ministries involved in taking action, a Department of Civil Protection was set up to ensure public protection and disaster mitigation. The international reality often adds another dimension, i.e. the involvement of the community in the management, and of the meaningfulness of using models in the management of such natural hazards. Examples of such models are the UDRO-USGS and the RPA models.

Human behaviour has contributed significantly to current health crises (Smith, 2009) and more often than not, emergency behaviours are put in place only in the face of an acute danger. Chronic dangers such as eruptions that occur sporadically may not attract meaningful reflection and planning. The other reality is the tough transition from traditional African cultures to modern cosmopolitan value systems (Monekosso and Martin, 2008: 26). It is probably against this background that emergency behaviours in the Bakingili area were limited to women and children, as it is customarily believed that women and children need more protection than men.

7.4   Challenges

A local author from Cameroon stated that people have been subjected to practically all known environmental hazards simultaneously and continuously. Not only is there no relief, but there are repeated emergencies, natural and man-made. Our ability to manage our physical and biological environment will be crucial to health and economic development' (Monekosso & Martin, 2008: 27-8).

Judging from all sources, it was clear that this is a complex and difficult matter, but could be facilitated by good political will and meaningful collaboration with local and national bodies, local structures and community members, including local councils. Community members expressed concern regarding water sources, had difficulty in understanding and accepting scientific views on causation of eruptions and were negative and concerned about evacuations to unknown areas. This challenge was genuine as there was looting in the village after departure to the camps. The health workers face the challenge of having to face an eruption with limited, if any, equipment and supplies, and are also in all probability, ill equipped to cooperate with the community, as they were not part of the rescue team.

7.5   Conclusion and recommendations

From the study as a whole, it is important to recognise that similarities and differences exist between individuals, groups and contexts. Therefore, a specific model that allows the community a major part and role in the planning, enactment and monitoring of such a potential grave health hazard is of paramount importance. Within and throughout the four sources of data, some critical elements are present within or relevant to the context of Mount Cameroon and its potential further volcanic eruptions. These elements are: nature of the eruption, views and perceptions of communities, and management which are interfering with religious and cultural practices, requiring attention.

In the first place, the need to focus on the critical, yet complex relationship with the mountain – acknowledging and collectively dealing with religious and cultural practices came to the fore. This would require a sensitive and patient understanding of such cultural practices and imbedded religious realities, of respecting and working with the

members of community to find a way of restructuring such practices in increasingly safer and healthier ways. Religion has also been demonstrated as an interfering or complimentary factor in volcanic hazard perception, prevention, reduction or mitigation. Religious influences on both the society and the volcano have been found to centre on a god (Chester *et al*, 2008; Gregg *et al* 2008; Bankoff, 2004). The god, as perceived, is a source of livelihood. This implies that belief in the god should be maintained with clarification of the hazard(s) and related health risks. Being judgmental with regard to such religious beliefs and cultural practices may hinder progress and create aversion. The interface between traditional and modern science in the study of volcanoes can therefore not be over–emphasised. Green *et al* (1990) confirmed that whatever a community does is integrated into its existing patterns of belief. Therefore, in discussing cultural practices, the cultural theoretical approach is always central, particularly in the midst of a risk (Thompson, 1980; Douglas, 1966). Simply put, cultural practices will always exist in the presence of a threat.

Secondly, it is important to involve and recognise community members as critical role-players in the management of such natural disasters (including the government, health services, the local chief and council). Social responses are complex and variable in time and space and may have a profound influence on the level of utilisation of any emergency plan being put in place.

In the third place, it becomes unnecessary to establish structures that users are unaware of, except in the context where mitigation takes a top–down approach, as is apparent in the findings of this study. However, Leiby (2008) advocates learning from the experiences of respondents to recent national and international relief efforts to ensure organisational and personal preparedness in dealing with complex ethical, moral, legal and medical issues during a disaster.

Fourthly, the upliftment and enhancement of health care services within the area, implementing a holistic public health care framework are crucial. More often than not, government publications focusing on risks are not likely to be understood by those at risk (Lave and Lave, 1991).

In the fifth place, the further development of skills, knowledge and support systems of health care workers, in this case, nurses practicing in the area came to the fore. In all instances, disaster planners must plan for health care worker-related issues as well, including transportation and communication (Chokshi *et al*, 2008). The health workers in this study (nurses and nurse aids) have shown that they are not fully prepared and may even require further education. In a model for health care workers, the epidemiological model in combination with the nursing process will probably facilitate professional development. The readiness to reduce the impact of any disaster and the possible prediction of its occurrence begins with sound planning. The aim of each management plan is to reduce the vulnerability of households and communities, to strengthen the capacity of national and local societies in disaster management, to determine the roles for national and local actors/societies, and to establish working and able networks (International Federation on Red Cross and Red Crescent, 2007).

In the sixth place, addressing the somewhat complex nature of directives both at national and regional level to enhance easy activation and implementation is essential. Thus, as stated in the collaborative model for community health action (Annis & Racher, 2005), it is important to develop a community spirit of being, followed by belonging, and, finally, of becoming active participants in the community assessment, planning, implementation and evaluation of its very real problems and solutions. The ability to recognise the risk, communicate with others and obtain information, participate in preparedness routines, mobilise actors in prevention, mitigation and management, cooperate with various institutions, people and organisations, utilise and support local health care providers are critical. The components proposed depicts the major areas of importance in developing an adaptable model for the community who may face possible further volcanic eruptions from Mount Cameroon, zooming in on religious and cultural practices, the collaboration of community members, the alignment of directives and structures, role-player involvement, and the re-alignment of health care services, as mentioned in Chapter 6.

Therefore, a three-step implementation approach is advocated. Although most ethical values are relevant or applicable most of the time, an effort was made to highlight the most critical values based on an immersing in and understanding of all data collected

over time during the study. The following principles are of importance within and across all three steps:

- Communities are always capable of identifying and, to an extent, prioritising their needs.

- The reality of being part of a community one serves is an asset that can be of great benefit in community work.

- Integration into community life exposes health workers to contextual norms and values that aid acceptance – change is effected when there is adequate confidence.

- Every environment is unique, and both natural and man-made structures within every environment could be considered 'hazardous' – unpredictable and requiring preparedness, insight and, most importantly, a sense of being, belonging and becoming.

In reflecting on the above, the following three steps are considered important to manage health hazards related to Mount Cameroon eruptions:

Step One: The development of strong ties and relationships with all role-players, emphasising communication and cooperation. Easy recognition of a hazard and communicating with others is crucial.The expressed wish to be involved is an element of belonging, as in Annis & Racher (2005). In order for this to happen, the values of trust, tolerance and transparency are critical.

Step Two: The joint analysis, recognition of risks/hazards, healthcare and educational needs and management. The values of togetherness and the sharing of skills, knowledge and attitudes are considered critical. Individual and joint monitoring is essential as the signs of eminent eruptions are understood. In the case of availability of monitoring equipment, participation in the monitoring includes meteorological surveillance, adoption of directive frameworks, and making communities aware of managerial departments and roles in risks mitigation.

Step Three: The development of meaningful management/mitigation and monitoring strategies in cooperation with all stakeholders and role-players, supported by meaningful developmental activities. Aspects to be negotiated relate to, for example,

risk monitoring, warning and safety measures, communication, and equipment, the provision of health care and logistical arrangements. Some of the values imbedded are holism, empowerment, engagement and maintenance. The empowerment is further enhanced making safety messages available by bill boards, hand bills and home calendars of prevention, mitigation and control of eruption hazards around the Mount Cameroon volcano.

7.6   Limitations of study and research recommendations

The limitations of the study and associated recommendations are discussed within the context of the research milieu, data collection and analysis processes:

- The limited scope and application regarding the focus group discussions may be considered by some to be a concern that is often levied at so-called small participant group sizes. The generalisation of findings is thus questioned, although one needs to remember that it was a relatively small community in which the researcher applied a unique inclusion criterion of having lived through such an ordeal. It would, however, be interesting to replicate such a study in another context.

- The model, as presented, provides a framework for further refinement and adaptation, and is thus true to its nature of being an adaptable model. This may lead to some concern as the basic tenets are stated in somewhat relative and not too narrow terms. Each of these has, however, been carefully informed by the data. The matrix, as presented in Chapter 6, is considered to be important in terms of the way forward, providing more insight with regard to the realities and concerns of role-players and the content of data sources. The further refinement and testing of the model with the different stakeholders is advised.

- Participant selection was based on the voluntary willingness to participate, thus limiting the number of participants and possibly leading to a concern regarding representation. The decision to jointly report on the three groups may have taken away the opportunity to further refine data analysis by examining the sensitive differences between men, women and elders. It is recommended that future studies on this topic should investigate the differences in perceptions between such groups and its effect on relationships, growth and change management.

- The researcher is a known academic and nurse in the region, which may have influenced the participation of focus group members, especially within the health worker group. The presence of the scribe and other individuals to support the focus group discussions may have influenced group participation in general, especially as they were members of the so-called scientific community. The use of the researcher as instrument has been widely debated, and it would be important in future methodological studies to determine such effects, especially in studies of this nature.

- The complex nature of the scientific base of volcanic eruptions proved somewhat demanding intellectually, particularly with regard to summarising, analysing and presenting the material in a meaningful way – both in the analysis of documentary evidence and the literature review. It required substantial energy to provide it at this level, and the decisions as to what to include and exclude were rather complex. It is hoped that it does, however, provide a meaningful basis for future reflections.

7.7   Implications of the study

Nursing, in particular, and health care, in general, in Cameroon need to take cognisance of the importance of a community health service that is in touch with communities and that works with communities to determine solutions of mutual benefit and value. This will require the empowerment and support of nurses to do what is morally acceptable within a community setting. Respect and trust are valuable prerequisites of such an ethically sound approach.

Community members need to become an integral part of health care planning, intervention and monitoring strategies, acknowledging their important and unique contribution as to what matters most in their lives – health and well-being.

Health education of community members as an ongoing process cannot be over-emphasised, empowering members to deal with the realities they face on a daily basis.

The incorporation of the social and mental health aspects of care, especially in a disaster-prone context, cannot be over-emphasised. These should include risk assessment, strategies to help in dealing with pain, grief, stress and other mental health realities.

Communication between all role-players, including government and local authorities are crucial. It is also true that breakdowns in communication or trust are not easily mended. This would, for example, refer to the community members' painful experience of being evacuated, as well as the loss of property and livelihood. Government official are also informed and called upon to review the measures put in place and bring them in alignment with the community capabilities.

Religious and cultural practices are part and parcel of one's identity, the way in which the individual will view matters and the way this individual will act. It is engrained in our view of the world and infuses our existence. It is also very difficult to change or alter such beliefs and practices, and thus needs tolerance, time and 'tender, loving care'. Unfortunately, natural disasters do not always allow such time or early warnings. It is thus critical that these realities are addressed in a careful, meaningful, and continuous manner.

It is always useful to reflect on the experiences of others – in this case, those who have dealt with similar realities or threats. Case studies, scenarios and presentations of such experiences may be used to great advantage, especially from trusted individuals or groups. The Chief, Elder and members of the Local Council are important respected figures in society, and they may be open and willing to work with health carers and other stakeholders and to lead by example.

> *It is the ultimate wisdom of the mountains that a man [woman] is never more a man [woman] than when he [she] is striving for what is beyond his [her] grasp (James, Ramsey Ullman)*

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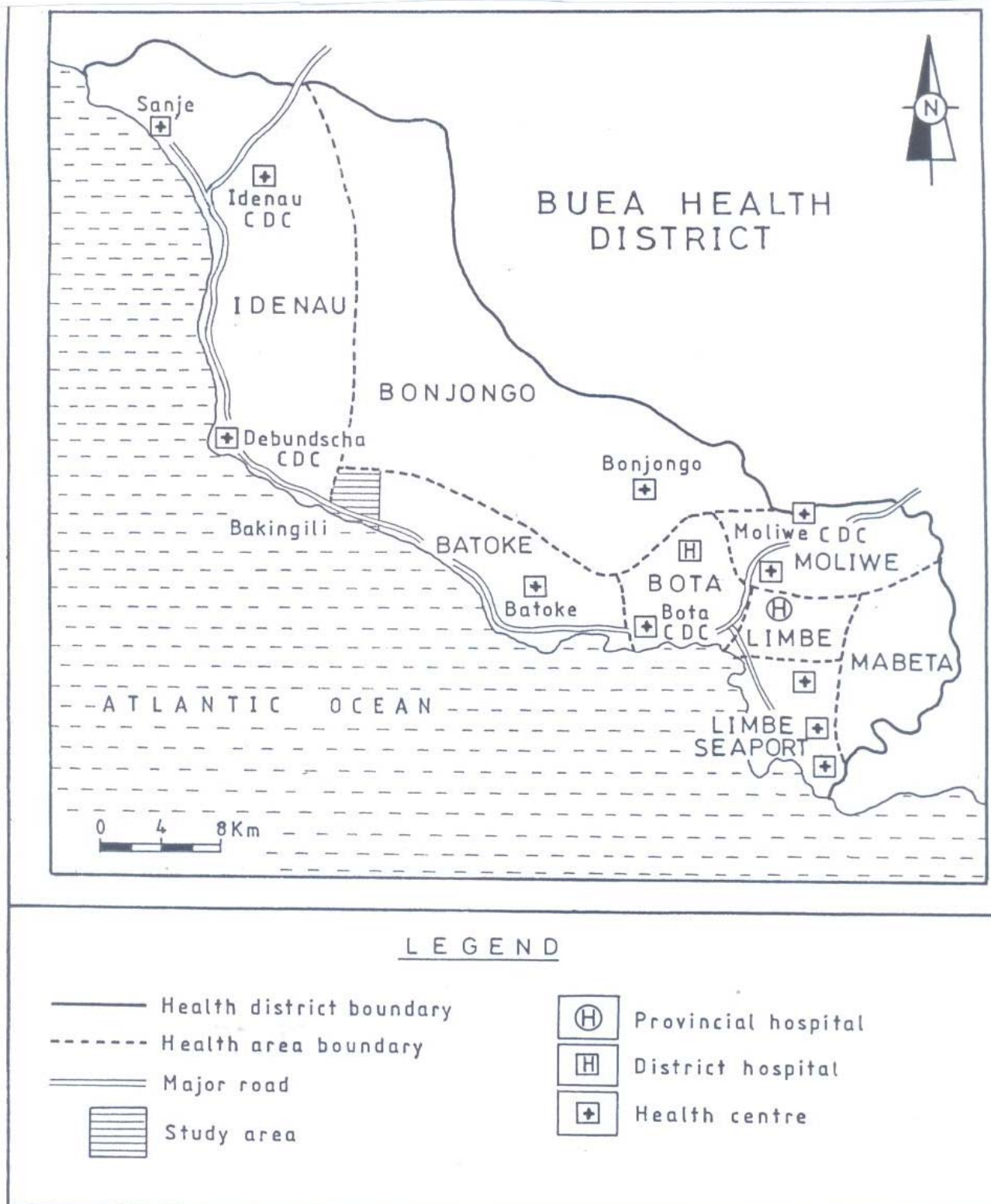
Appendix 1: The Cameroon Volcanic Line
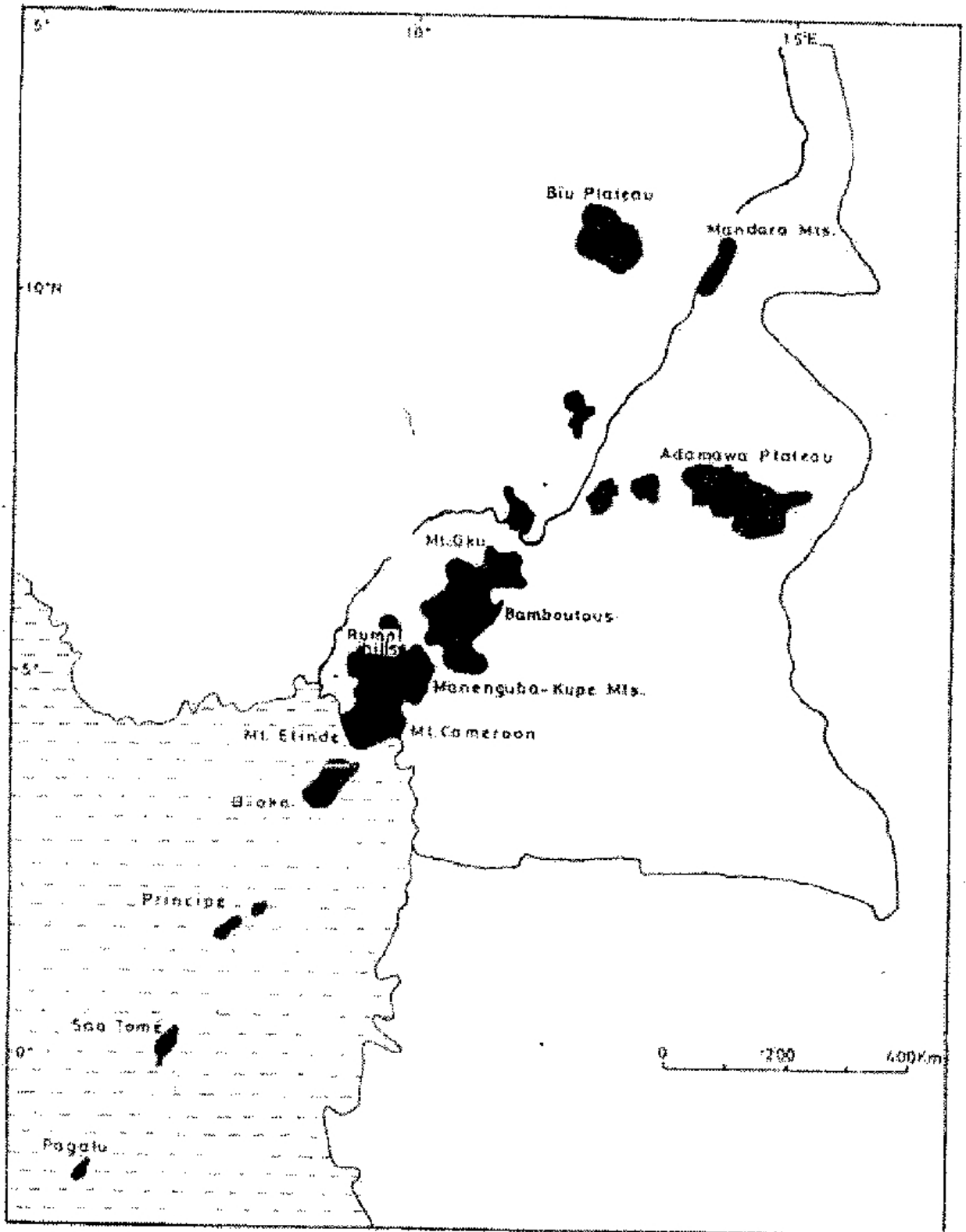
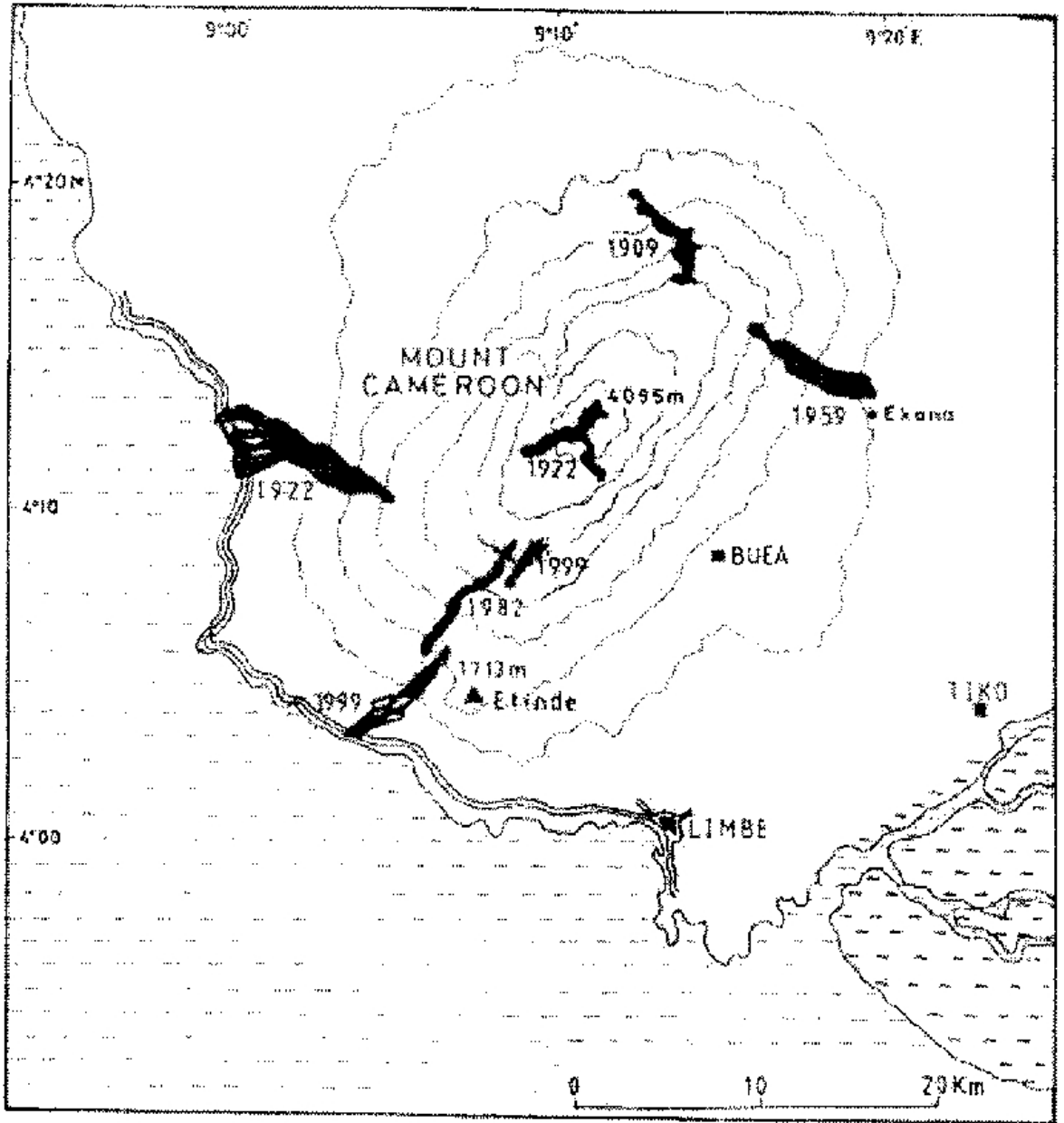**Appendix 2: Map of Cameroon showing two eruption sites and surrounding Villages**
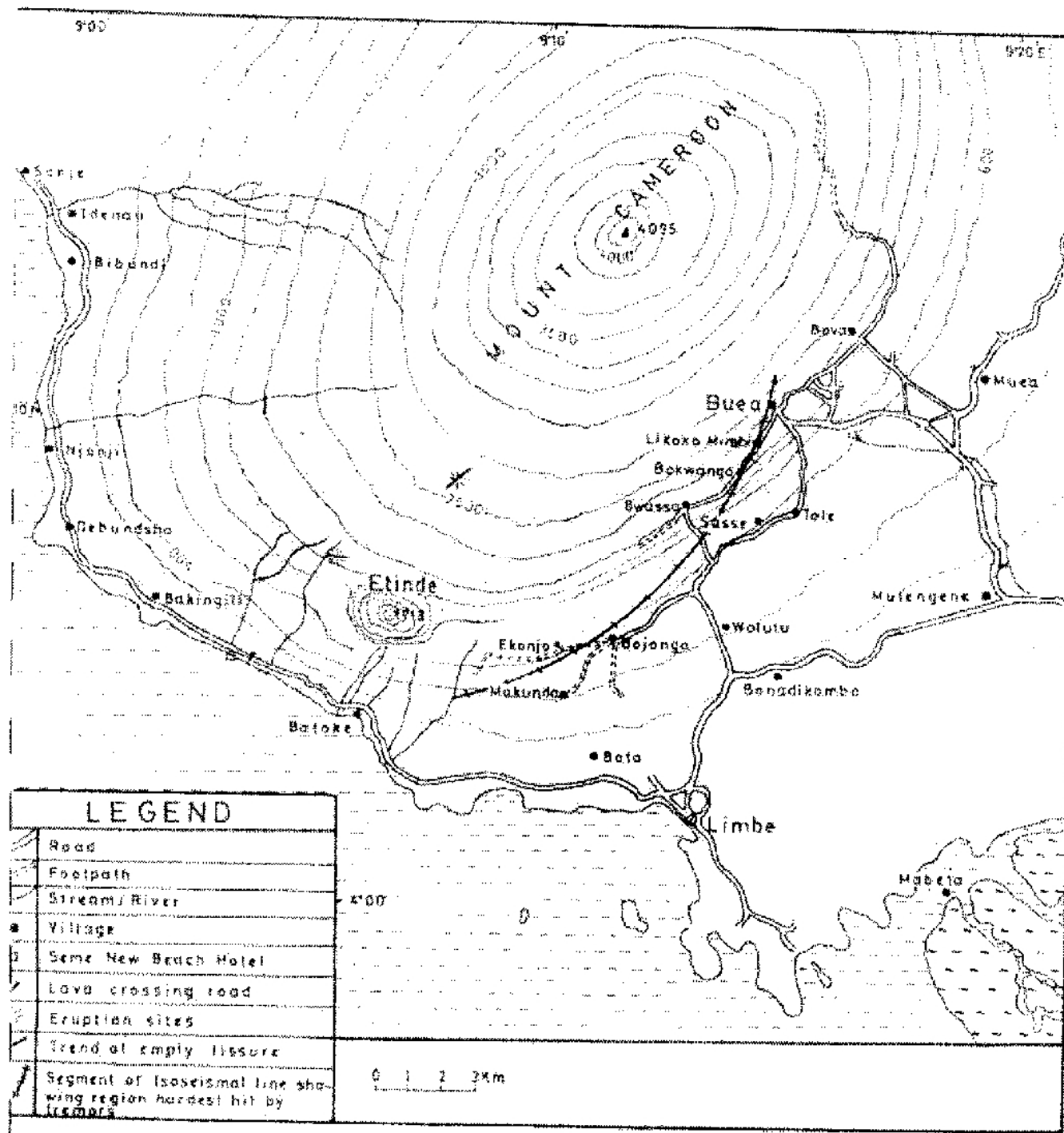
Appendix 3: The Limbe Health District and Health Facilities

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Appendix 4: Positions of eruptions and lava flows of Mount Cameroon during the 20th Century

Appendix 5: Informed consent

Mrs Mary Atanga is a nurse lecturer at the Department of Nursing, University of Buea, trying to collect information on what should be put in place or what is most appropriate to community when the mountain erupts (research purpose). She believes that the research will provide information on the views and doings of the community members of the mountain and its eruptions, and identify preferable ways of doing things from the community perspective for the development of a workable model to help out when the mountain erupts (Study benefits). She realizes that the study will take approximately 60-80 minutes of your time and will involve discussions on the topic (research purpose).

I know that my participation in this study is voluntary (Voluntary consent). I also know that my participation will be confidential in whatever I will say (confidentiality), that I have a right to withdraw whenever I am uncomfortable (option to withdraw), and that I will be protected from any form of harm during the process, if any (protection from harm). If I have any question about the study during a non session period that I can call Mrs Atanga at (237) 77 23 97 37 (opportunity to ask questions)

I agree to participate in this study and have signed the consent form and I have been assured that my identity will not be disclosed (confidentiality).

Date--------- Participants sign----------- Gender------- Age------ Investigator------

Appendix 6: Authorization to carry out research from the Regional Delegate for Health, South West Region (formerly-Province)

REPUBLIQUE DU CAMEROUN *Paix - Travail - Patrie*	REPUBLIC OF CAMEROON *Peace - Work - Fatherland*
MINISTERE DE LA SANTE PUBLIQUE	MINISTRY OF PUBLIC HEALTH
DELEGATION PROVINCIALE POUR LE SUD OUEST	PROVINCIAL DELEGATION FOR THE SOUTH WEST

Tel 332 22 10 General office
      332 22 62 Provincial Delegate
      332 29 43 PHC Drug Programme
      Email PDPH: pdph_sw@yahoo.com
      Email PTB Unit: ptbqu_sw@yahoo.fr

BUEA the: **1 4 OCT. 2005**

N° 1 1 1 /MPH/SWP/PDPH/PSCH/ 2073/5   The Provincial Delegate

SUBJECT: **REQUEST FOR ETHICAL CLEARANCE**

To: Mary Bi Suh Atanga
    Department of Nursing
    Faculty of Health Sciences
    University of Buea

I acknowledge receipt of your request for an Ethical Clearance to carry out a study on The Development of a Community Health Model to Manage Health hazards of Mount Cameroon eruptions, West Africa in Bokwaongo and Bakingili communities in the Buea and Limbe Health Districts respectively.

I have read your proposal through and found it very interesting. Certainly the results of your will be of great importance and use in our work as health personel.
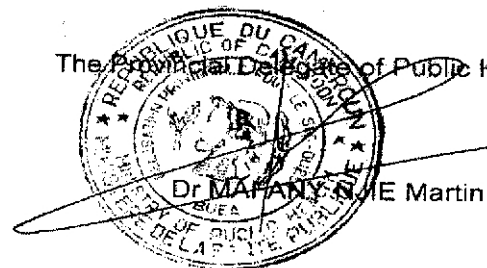
You, therefore, have my approval for the study in these health districts.

I wish to inform you to get in touch with District Medical Offices of Buea and Limbe during your study.

We look forward to the results of your study.

God bless you in your endeavours.

The Provincial Delegate of Public Health

Dr MAFANY N/E Martin

Cc
District Medical Officers
Buea & Limbe
For information and necessary action

Appendix 7: Request to carry out research

From: Mrs Mary Atanga
Department of Nursing
Faculty of Health Sciences
University of Buea
March 21st 2008

To: H.R.H. The chiefs of Bokwoango and Bakingili Villages

Subject: Request to carry out research in your village

I hereby make this request to enter the village for the purpose of research on working with you and your community in trying to develop a community adaptable model for managing health hazards of Mount Cameroon eruptions.

As a worker of the University of Buea, part of our work is to carry out research, obtain results and use them to inform policy, gain academic degrees and promotions and improve on community health-seeking behaviour.

I will therefore be talking to community leaders, health care providers, men, and women during group discussions.
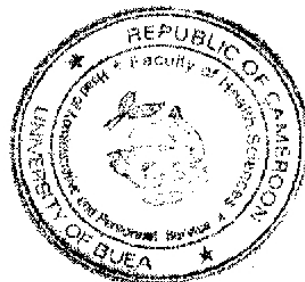
Kindly permit me to carry out the exercise slated for the month of April 2008.
I have attached the authorization from the provincial delegate for public health, South West province, Cameroon.

Thank you very much in advance

Mary Atanga (Mrs)

Appendix 8: Signed request by local chief of the community concerned

UNIVERSITY OF BUEA

P.O Box 63,
Buea, CAMEROON
Tel: (237) 332 21 34/332 28 13
Fax: (237) 332 22 72

REPUBLIC OF CAMEROON
PEACE – WORK - FATHERLAND

FACULTY OF HEALTH SCIENCES

Dean   : Professor Peter Martins NDUMBE
Vice-Dean   : Dr. Achidi Eric Akum
Faculty Officer : Mrs. Florence Martin

Your Ref: _____

Our Ref: _____

Chief of Service of General
Administration and Personnel
Faculty of Health Sciences

Date: 2 3 APR 2008 _____

Seen and accepted
chief of Bokwango
Molma Messeh
April 24, 2008

To

The chief and/or village elders of Bkingili, Idenau Rural Council Area

Dear Sir,

Subject: **Permission to carry out research in your community**

We are a research team from the University of Buea carrying out research on **"A community Health Model to Manage Health Hazards of Mount Cameroon, West Africa."** We wish to request your permission to carry out this research. We have been permitted by the Health authorities to carry out this research. Considering that this area is on the slope of the Mount Cameroon which is a volcanic mountain, this research will help us to unveil better management strategies of health hazards in this area The results obtained will therefore be of help to the inhabitants of this community. We count on your cooperation.

Mrs Atanga Mary

Faculty of Health Sciences

University of Buea

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UNIVERSITY OF BUEA

P.O Box 63,
Buea, CAMEROON
Tel: (237) 332 21 34/332 28 13
Fax: (237) 332 22 72

REPUBLIC OF CAMEROON
PEACE – WORK - FATHERLAND

FACULTY OF HEALTH SCIENCES

Dean : Professor Peter Martins NDUMBE
Vice-Dean : Dr. Achidi Eric Akum
Faculty Officer : Mrs. Florence Martin

Your Ref: _____

Our Ref: _____
Chief of Service of General Administration and Personnel Faculty of Health Sciences

Date: 2 2 APR 2009

To

The chief and/or village elders of Bokwango, Buea

Dear Sir,

Subject: **Permission to carry out research in your community**

We are a research team from the University of Buea carrying out research on **"A community Health Model to Manage Health Hazards of Mount Cameroon, West Africa."** We wish to request your permission to carry out this research. We have been permitted by the Health authorities to carry out this research. Considering that this area is on the slope of the Mount Cameroon which is a volcanic mountain, this research will help us to unveil better management strategies of health hazards in this area The results obtained will therefore be of help to the inhabitants of this community. We count on your cooperation.

Mrs Atanga Mary

Faculty of Health Sciences

University of Buea

Accepted by.
Reagent of Bakingili
Joseph Elive
23/04/09

Appendix 9: Excerpts of exploratory (pilot) study

P 1: CAM-BAK-FGD-F-A-CM-08-PHD-02.rtf - 1:1 [well the things that show that..] (28:28) (Super)
Codes: [Know-Erupt-Pre]
Memos: [Community knowledge of pre-eruption signs]

well the things that show that the mountain has to erupt are first of all the trembling of houses, after this, we see smoke oozing out from the mountain during the day and at night. you see the mountain becomes red. (meaning that they see fire on an area of the mountain). these are signs that the mountain has to erupt.

Memos:
   MEMO: Community knowledge of pre-eruption signs (Super, 08/08/08 06:47:02 PM)
   Type: Memo

   Community members have good knowledge of pre-eruption signs. They capitalized on tremors as one of the main pre-election features.

P 1: CAM-BAK-FGD-F-A-CM-08-PHD-02.rtf - 1:2 [firstly, there is a strong win..] (30:30) (Super)
Codes: [Know-Erupt-Pre]
No memos

firstly, there is a strong wind that passes, the houses and coconut trees do shake, even the ground shakes.

P 1: CAM-BAK-FGD-F-A-CM-08-PHD-02.rtf - 1:3 [when the mountain is about to ..] (32:32) (Super)
Codes: [Know-Erupt-Pre]
No memos

when the mountain is about to erupt, we have ashes all over the place, when you carry water and keep you find ashes settled on it, when you go to the farm, the ash burns you on the back and other exposed parts of the body.

P 1: CAM-BAK-FGD-F-A-CM-08-PHD-02.rtf - 1:4 [even the streams that we fetch..] (33:33) (Super)
Codes: [Know-Erupt-Pre]
Memos: [Other main signs of pre-eruption]

even the streams that we fetched drinking water from there before now, one could also find ash on it, the colour becomes brown whenever an eruption is about to occur.

Memos:

focus group discussion with elders, adult male and female members the bokwoango community.

community - bokoango

age - adults aged 24 to37 years

time started - 11:00 am

time ended - 11:42 am

original language - english/pidgin english

cordinator – mary bi suh atanga

translator - theobald mue nji

transcribe by - theobald mue nji

note taker: mih mathias

date - 18th January 2008

list of some participants.

name	age	profession	gender	position in the community.
elive njie	34	businessman	male	member
mola sammy	30	farmer	male	member
helen enanga	28	trader	female	member
mofa elive	35	trader	male	member
fominyen beatrice	37	hair dresser	female	member
nammeh mboa	40	farmer	male/elder	member
kinge	47	retired officer	male/elder	member

my name is mary atanga, I am a nurse and lecturer at the university of buea and as you were told, we are a team of researchers from the University of Buea. the provincial delegation of Health for the South West has approved that we can go on with what we are doing, we are here today in the community of bokoango to see how we work together to develop an adaptable model of handling emergencies of mount Cameroon and its eruptions. with me here is mr.theobald mue nji, a social scientist, university of buea. the other person is dr. mih mathias, also a lecturer with the university of buea.

this conversation will last for about forty minutes and i wish that you people should please participate in the discussion. may i know if you are willing to take part?

r-we are at the disposal.

r-you may even take more than forty minutes.

r-i am ready to answer all your questions.

r- we are willing.

q- the first question is, what are your views of the mount cameroon ?

r- it is the chariot of the gods and which sometimes erupts and this shows by:em when the mountain has to erupt are first of all the trembling of houses, after this, we see smoke oozing out from the mountain during the day and at night. you see the mountain becomes red. (meaning that they see fire on an area of the mountain). these are signs that the mountain has to erupt.

q- has somebody got something else to say?

Appendix 10: Excerpt of sample of data analyzed and codes used for analysis

CODE LIST FOR THE ANALYSIS OF QUALITATIVE DATA
USING ATLAS ti 5.0

Codes	Code names	Code descriptions
Gen-Know-Erupt-Com	Community general knowledge of eruption	To find out the general knowledge of community members on eruption.
Date-Last-Erupt	When Mount Cameroon last erupt	To find out the knowledge of community members on the date the Mount Cameroon last eruption took place.
Know-ComL-Pre-Erupt	Knowledge of community leaders on the pre-eruption	To find out the knowledge of the community leaders concerning eruptions in the pre-eruption periods.
Know-ComL-Dur-Erupt	Knowledge of community leaders during the eruption	To find out the knowledge of the community leaders concerning eruptions during the eruption periods.
Know-ComL-Post-Erupt	Knowledge of community leaders on the post-eruption	To find out the knowledge of the community leaders concerning eruptions in the post-eruption periods.
Know-Erupt-Pre	Knowledge of pre-eruption	To find out the knowledge of the community members concerning eruptions in the pre-eruption periods.
Know-Erupt-Dur	Knowledge during the eruption	To find out the knowledge of the people concerning eruptions during the eruption periods.
Know-Erupt-Post	Knowledge of post-eruption	To find out the knowledge of the people concerning eruptions in the post eruption periods.
Know-Gov-Pre-Erupt	Knowledge of government authorities on the pre-eruption	To find out the knowledge of the government authorities concerning eruptions in the pre-eruption periods.
Know-Gov-Dur-Erupt	Knowledge of government authorities during the eruption	To find out the knowledge of the government authorities concerning

Appendix 11: Excerpts of flow of discussions during focus group

From all 1-6 discussions, facilitators and participant worked with an understanding of the main categories, sub categories and themes emerged. The 16 participant all took various turns during the discussions (two sets of discussions) in the various groups. A total of 6 elders (in their group), 5 women (in their group), 5 men (in their group).Responses were noted as saturation points were reached. The participants were numbered from elders through women to men. In all discussions the flow went from views, to doings, effectiveness, resistance, co operation and emergency behaviors. Same was carried out among the 5 health workers during their own discussions (Appendix 10b below)

Principal investigator (who was also the facilitator):
"Good evening all, we are here as we agreed during your Sunday meeting to discuss on the mountain, its happenings, impacts and ways of mitigating hazards. We will discuss the views and other main categories in light of themes as they will emerge in course of our talking together. Thank you, and with your permission thank you once more for accepting to come".

All participants:
"You are welcome"
Facilitator:
"Thank you once more. Let us start. Let me be general for this start; What does this mountain stand for; What is it or what does it represent?"

Participant 1:
"In the Bakweri tribe, we see the mountain as the home of the gods in English but we call it 'Epasa moto' meaning the 'chariot of the gods' ".

Facilitator:
"What are the gods suppose to be doing or what do these gods do?"
"Nodding cannot be registered by this recorder; you must talk before it can record. Any other answer from some else please"?

All participants
"Our strength is in them. They protect us" and so on.

Next Group
Facilitator: Welcome everybody. We are here to look at how we can jointly act in an event of any natural hazard or in general act in the face of a disaster. In so doing we will have to make an overview of the knowledge/ understanding of the Mount Cameroon and its activities, cultural belief patterns and practices around this phenomenon; values attached to the phenomenon and your opinion on what should constitute an adaptable model. With me are Mr Theobald Nji- a social scientist who will tape all what we say in order for us to remember and build a better model, Dr Mih Mathias, who will take down notes and my humble self Mrs Atanga Mary will be helping us to make the discussions to continue flowing.

Participant 6: You are all welcome too, only that you may finish and just go and we will never know what really happened.

Facilitator: We will come back tomorrow and tell what we listened to so that you confirm and we make further clarifications.

Participant 6: It will be good like that but, as we have said please remember to put just one name each.

Facilitator: Then let us begin with the understanding of the mountain. How is the mountain perceived?

Participant 7: Our people belief that the mountain is a source of strength as we call it 'the chariot of the gods'

Facilitator: Why do you call it strength? Another participant- please.

Participant 8: The gods protects us, that is why the eruptions will always begin with tremors; so we know something is about to happen before scientists and government starts to inform.

Facilitator: You mean that government information is also a source of strength?

Participant 8: Yes, they even make us to understand the impacts of eruption, though they have never spoken about water pollution directly to us but we can see that our springs are touched and we suffer from skin and eye irritations.

Facilitator: How do see the fact that government has not spoken about the water pollution directly?

Participant 9: When eruptions begin the gods are appease and as the elders go into the forest for the process they see how close our spring sources are close to the eruptions. But appeasement process is strength though the water problem could be a difficulty.

Facilitator: Do you mean difficulty in the views of the mountain, its eruptions or impacts?

Participant 10: We have difficulties in different ways because we were here when the mountain erupted and there were conflicting views.

Facilitator: what were these difficulties?

Participant 8: Sometimes there is a difficulty of believing that the death of somebody will cause the mountain to erupt.

Participant 7: Is it only that sometimes they say is the annoyance of the gods.

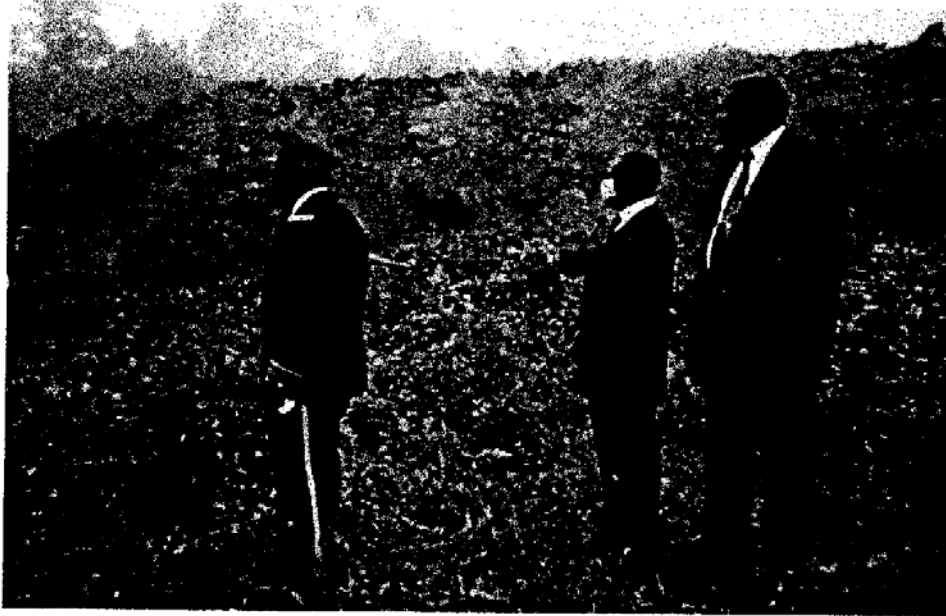**Appendix 12: National Scientific Committee at eruption site**

Plate 5. Concerned authorities watch in awe the advancing mass of the Bakigili Lava Flow. *Left to right: The Governor of the S.W. Province (Mr. Acham Peter Cho), The Minister of Territorial Administration (Mr. Samson Ename Ename), The General Manager C.D.C. (Mr. Henry Njalla Quan), and a member of the Evaluation Committee.*

Plate 6. The Prime Minister (**Mr. Peter Mafany Musonge**) and wife meet the Head of the Evaluation Committee, Director of Civil protection in the Ministry of Territorial Administration (**Madam Enach Enaek.**)

Appendix 13: Effects of eruptions on the environment

Effects of the Tremors -

Plate 7. A visit to a seriously damaged building (The Presidential Lodge at Bokwango) by the Prime Minister (Mr. Peter Mafany Musonge -at the door) and the Minister of Territorial Administration (Mr. Samson Ename Ename). They were accompanied by the Provincial Crisis Commission.

Plate 8. The Minister of Territorial Administration (Mr. Samson Ename Ename) giving an interview during one of his assessment trips.

Also in the picture are: The Governor (Mr. Acham Peter Cho - behind the Minister) The Director of civil Protection in MINAT (Madam Enack Enack) The S.G. of the S.W Province (Mr. Ngalle Kingue - to the right of the Director), the S.D.O. for Fako (Mr. Robert Meka - to the extreme right), the Chairman of the Scientific Committee (Dr. S.N. Ayonghe - behind the S.G.) and the S.G. of the Scientific Committee (Mr. E.S. Njumbe - extreme right back row.

Appendix 14: Some short and long term recommendations for managing eruption hazards of Mount Cameroon

Recommendations as stated in this report are in the form of short and long term measures to be taken in monitoring the eruption as well as mitigating and/or preventing associated hazards. The National Scientific Committee, therefore, thinks it absolutely necessary for Government to set up centres responsible for monitoring volcanoes and other natural phenomena and mapping out mitigation strategies for hazards from such phenomena. Such centres could be located in Research Institutes and Universities in the immediate vicinity of the mountain.

1. Short Term Measures

A number of short term measures have already been taken towards mitigation and management of the immediate hazards from the eruption. These include the setting up of the Provincial Crisis Commission and the National Scientific Committee, evacuation and settlement of populations considered to be within the high risk zones. Other short term measures recommended here include educational programmes on natural hazard awareness for persons living in areas prone to earthquakes and eruptions; systematic and continuous control of food and water used by affected populations, and continuous field and aerial observations of the eruption sites.

a. Educational Programme on Natural Hazard Awareness

It is important to design educational and information programmes towards increasing the level of awareness of hazards associated with volcanic eruptions and other natural phenomena.

On Seismic Risks

Vulnerable populations should:

- Avoid steeply sloping topography as these could be favourable sites for earthquake - triggered landslides.
- Stay away from or out of poorly constructed and partially damaged buildings for as long as the eruption lasts.
- Move out of buildings orderly and without panic during tremors.
- Report any anomalous observation that may be related to tremors to the administration.

On Volcanic Risks

- Keep away from explosively erupting vents and cones.
- Avoid coming close to erupting fissures and vents emitting dangerous gases like CO_2, H_2S, and SO_2. These gases and others may have long and short term harmful effects which may not be perceived or manifested immediately.
- Refrain from over staying out of their houses during ash falls. These ashes could be the source of respiratory, skin and eye diseases (cases of conjunctivitis have already been identified). If they

must go outside, they should endeavour to put on goggles and gas masks. This is really important for those populations along the west coast that have not been evacuated.

• Avoid coming too close to active lava fronts or climbing on solidified lava flows for now. Fronts are potential sites for mass movement of precariously hanging blocks of lava.

b.   Control Of Food And Water

There should be put in place a systematic and continuous control of the food and water consumed by the population along the west coast. Certain gases emitted from erupting vents and blown in the direction of these settlements could give rise to acid rains capable of polluting surface and ground water sources and destroying forests and plantations. Results of analysis of water samples from the west coast (table 2) indicate that there has not been any perceptible amount of chemical contamination to be linked to volcanic ashes and /or gases. However, the results show a high level of bacterial contamination (of faecal origin) making it unsuitable for human consumption.

c.   Aerial Observations And Monitoring Of Eruption Sites

Continuous monitoring of the eruption sites from the helicopter will enable a progressive assessment to be made on the evolution of the eruption and its possible risks. In this way, the emergence of new vents and lava fronts will be detected in time and necessary steps would be recommended/taken against any hazards.

d.   Monitoring Of Volcanic Lakes

Volcanic lakes along the Cameroon volcanic line should be monitored as some of these lakes have exhibited fatal physical and chemical changes during and a few years after eruptions. During the 1959 eruption, it is reported that temperature increases in lake Barombi Mbo provoked the death of fishes. Again two and four years after the 1982 eruption lethal gas outbursts from lakes Monoun (1984) and lake Nyos (1986) were the cause of loss of human and animal life.

e   *Road Network*

There is absolute need to put in place an adequate road network in and around Buea to ease evacuation in the event of an eruption on the eastern flank of the mountain.

2.   Long Term Measures

People and settlements around active volcanoes are constantly under threat of eruptions and seismic activities. Historical volcanic eruptions have caused deaths and the destruction of forests and even entire cities. Vesuvius (1631) Tambora (1815), Krakatoa (1883), Pelee (1902) and St Helens

(1980) are examples of such destructive eruptions. Being an active volcano, mount Cameroon needs constant and continuous monitoring.

The upgrading and reinforcement of the Ekona Geophysical and Volcanological Observatory as well as the creation of new centres is highly recommended. Such centres will effectively monitor the mountain and the chain of volcanic lakes along the Cameroon Volcanic Line. As a matter of fact, the evolution of the present eruption in a NE direction is a cause for concern. This direction happens to be towards the summit of the mountain and the reactivation of the erupting fissure could trigger another eruption in a not-so-distant future.

A list of scientific equipment for the Ekona Observatory has been forwarded to the authorities. The provision of these will bulwark an assurance, on the part of Cameroonian experts, to Cameroonian vis-à-vis their being kept informed as to any impending natural phenomenon especially those associated with mount Cameroon and the regional volcanic line. With these, the government will serve itself the trauma of disbursing huge amounts of money in consulting and inviting expatriates to carry out what their citizens could equally do at relatively insignificant cost.

Also recommended is the recruitment of specialised researchers to man the equipment, organisation of technical training programmes for the researchers and the recruitment of qualified electrical engineers for constant maintenance of the equipment. The provision of telecommunication equipment is also highly recommended.

In all, the provision of the requested scientific equipment will be able to tackle the following long term measures:

*   Analysis of rock, gas and water samples from present and future eruptions. This goes a long way to explain the explosiveness or dynamics of the eruption.

*   A comprehensive geological and geophysical data base to be put in place. This will be the crucial prerequisite for improving the evaluation of seismic and volcanic hazard potentials as well as attempting any prediction of these phenomena. From such data, building codes can be developed for high risk zones.

Finally, it will be important to set up public enlightenment groups in identified seismogenic areas to improve the seismic hazard awareness of the people, thus enabling them to participate and act accordingly during emergency.

Appendix 15: Abstract of article on characterization of ash from eruption 1999-2000

Volcanic Ash from the 1999 Eruption of Mount Cameroon Volcano: Characterization and Implications to Health Hazards

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ABSTRACT

Volcanic ash from the 1999 eruption of Mount Cameroon volcano has been characterized for its particle size and shape (by scanning electron microscopy, SEM), and mineralogy (by X-ray diffractometry, XRD). Also the total fluorine (F) content of the ash was determined by the selective ion electrode method. The results show that the Mount Cameroon ash particles have a variety of shapes including fibrous, rounded, subrounded, irregular, angular, elongated and bladed. All the ash samples have a significant proportion ($\sim$ 30%) of ash < 4 µm in size and this is classified in occupational medicine as 'thoracic' and 'respirable' ash that is considered harmful to health. The XRD patterns show that the ash contains plagioclase feldspar, enstatite, augite and chromite, which, if fine enough may cause irritation of the respiratory tract, but they are relatively insoluble in the alveolar region. The ash lacks free silica, the main mineral in volcanic ash responsible for causing silicosis. The F concentration in the ash ranges from 46 µg/g to 189µg/g. This is high considering that the lethal dose of F is set internationally at $\sim$ 100µg/g. This study forms the basis for a long term monitoring of volcanic ash risk and possible mitigation measures of the Mount Cameroon volcano.

Keywords: volcanic ash, Mt. Cameroon, health hazards

RESUME

Cendre de Volcan de L'Eruption de 1999 du Mont Cameroun: Caracterisation et Implications aux Risques Sanitaires.

La cendre de volcan de l'éruption de 1999 du mont Cameroun a été caractérisée pour la dimension et la forme de ces particules (en utilisant la microscopie électronique a balayant, SEM), et minéralogie (diffractométrie a rayon X, XRD). En outre toute la teneur en fluor (F) de la cendre a été déterminée par la méthode sélective d'électrode d'ion. Les résultats prouvent que les particules de cendre du mont Cameroun ont une variété de formes comprenant : les fibreux, les arrondies, les sous arrondies, les irréguliers, les angulaires et les ovales. Tous les échantillons de cendre ont une proportion significative de ($\sim$ 30 %) de cendre ayant la taille < 4 m et ceci est classifié dans la médecine du travail comme la cendre 'thoracique' et 'respirable' qui est considérée nocif à la santé. Les modèles de XRD montre que la cendre contient le feldspath de plagioclase, l'enstatite, l'augite et la chromite qui, s'ils sont assez fins, peuvent produire l'irritation de la cavité nasale mais sont relativement insolubles dans la région d'aveolaire. La cendre manque de la silice libre, qui est le minerai principal de la cendre volcanique responsable d'engendrer la silicose. La concentration de F dans la cendre s'échelonne de 189 g/g. Ceci est élevé considérant que la dose mortelle de F est placé internationalement aux environs de $\sim$ 100 g/g. Cette étude forme la base pour une surveillance à long terme du risque volcanique et des mesures possibles de réduction du volcan de mont Cameroun.

Mots clés : cendre de volcan, Mont Cameroun, risques sanitaires

Appendix 16: Abstract of article on preliminary studies of this study on Mount Cameroon hazards and community model – International Journal of Mass Emergencies and Disasters (in press)

Health System Preparedness For Hazards Associated With Mount Cameroon Eruptions—A Community Perspective: Case Study Bakingili Village

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Mount Cameroon, the only active volcano along the Cameroon Volcanic Line (CVL) and most active in equatorial West Africa, erupted seven times in the last century. The 1999 eruption prompted evacuation of over 600 inhabitants of Bakingili village on the south western slopes – the first in the history of this volcano. Besides destruction from flowing lava, associated health hazards resulted from fine ash and poisonous gases that accompanied explosions. This eruption revealed a lack of preparedness on the part of the communities and the Cameroonian administration to such phenomena, as a National Scientific Committee was only created following challenges from local scientists who began monitoring of the event only out of scientific curiosity. Consequently, the evacuation camp was not prepared for any emergency relief operations and there still remains a lot of mistrust between the community, local scientists and emergency managers. This study attempts to rebuild dialogue, respect and trust between these parties towards facilitating volcanic hazard education and planning for Mount Cameroon, especially, the health system preparedness. To achieve this, we used documentary evidence; focus group discussions; and data triangulation. Results show the need to adopt a combined 'top-down' and 'bottom-up' approach by integrating community members in decision making bodies; integrating and promoting local