



Seismic Risk in Ghana: Efforts and Challenges

Paulina Amponsah and Irene Opoku-Ntim

Abstract

Since 1939, Ghana has experienced its severest earthquake with a magnitude of 6.5 on the Richter scale, which killed seventeen people and caused a lot of damages to property. There have been reported occurrences of earth tremors in recent times, though the region is generally considered a stable continental area with few active tectonic features. Three recent earth tremors were recorded in the country in March and December 2018 and March 2019 with magnitudes ranging from 3.0 to 4.8 on the Richter scale. These tremors caused a lot of panics to the inhabitants of the most affected areas. Earthquake occurrence and observation surveys were conducted in March 2019 in the southern part of the country where the events were most felt. The main objective of the survey was to assess the perception, experiences and adaptation strategies of randomly sampled residents of the area to seismic events. Questionnaires were administered for the survey in the Awutu Senya East and Weija-Gbawe Municipalities. There were divergent views from the inhabitants on their perception, experiences and adaptation strategies to earth tremors in the area. We realized that most of the people were aware that they live in an earthquake prone area, but have no measures in place to mitigate the seismic risk. Therefore, the responsible government agencies need to conduct geological and geophysical investigation on every land acquired before releasing them to developers.

Keywords

Seismic risk • Coastal boundary fault • Akwapim fault zone • Awareness creation • Ghana

1 Introduction

The seismicity of Ghana is attributed to possible recent movements along the Togo, Birimian and Dahomeyan thrust faults (Bondessen and Schmidt 1972). Sykes (1978) emphasized the role of these faults in the high seismic activity in the region. The relative intense seismicity in the region is attributed to the resurgence of movement along ancient tectonic boundaries. Bacon and Banson (1979), Amponsah (2002), attributed the seismicity of Southeastern Ghana to the level of activity of the Akwapim fault zone with little activity along the Coastal boundary fault.

There have been reported occurrences of earth tremors in recent times in parts of southern Ghana namely Awutu Senya East and Weija-Gbawe Municipalities (Amponsah et al. 2012; Amponsah 2004; Akoto and Anum 1992). These events have thrown residents into fear and panic. Table 1 shows magnitudes and earthquakes recorded in Ghana from 1615 to 2019.

Earthquake occurrence and observation surveys were conducted in March 2019, to assess the perception, experiences and the adaptation strategies for the residents of these areas regarding the seismic events. Figure 1 is a map of Awutu Senya East and Weija-Gbawe Municipalities. The purpose of the survey was to disseminate information on seismic hazard to ensure that effective measures are taken in land development. Information was also sought for policy-making as well as advising the government on geo-scientific issues related to seismic events.

The questionnaire which was prepared by the staff of the **Ghana Atomic Energy Commission (GAEC)** had two sections. One section had to do with the socioeconomic background of the people and the other part dealt with the perceptions, experiences and adaptation strategies of the people to earthquakes.

P. Amponsah (✉) · I. Opoku-Ntim
National Nuclear Research Institute, Ghana Atomic Energy
Commission, Accra, Ghana

Table 1 Earthquakes recorded in Ghana from 1615 to 2019

Magnitude/Richter scale	Number of earthquakes
Less than or equal to 2	47
2.1–3.0	117
3.1–4.0	49
4.1–5.0	66
5.1–6.0	4
Greater than 6.0	2
Total	285

Source Amponsah et al. 2012; Doku 2013; CTBTO Sel 1

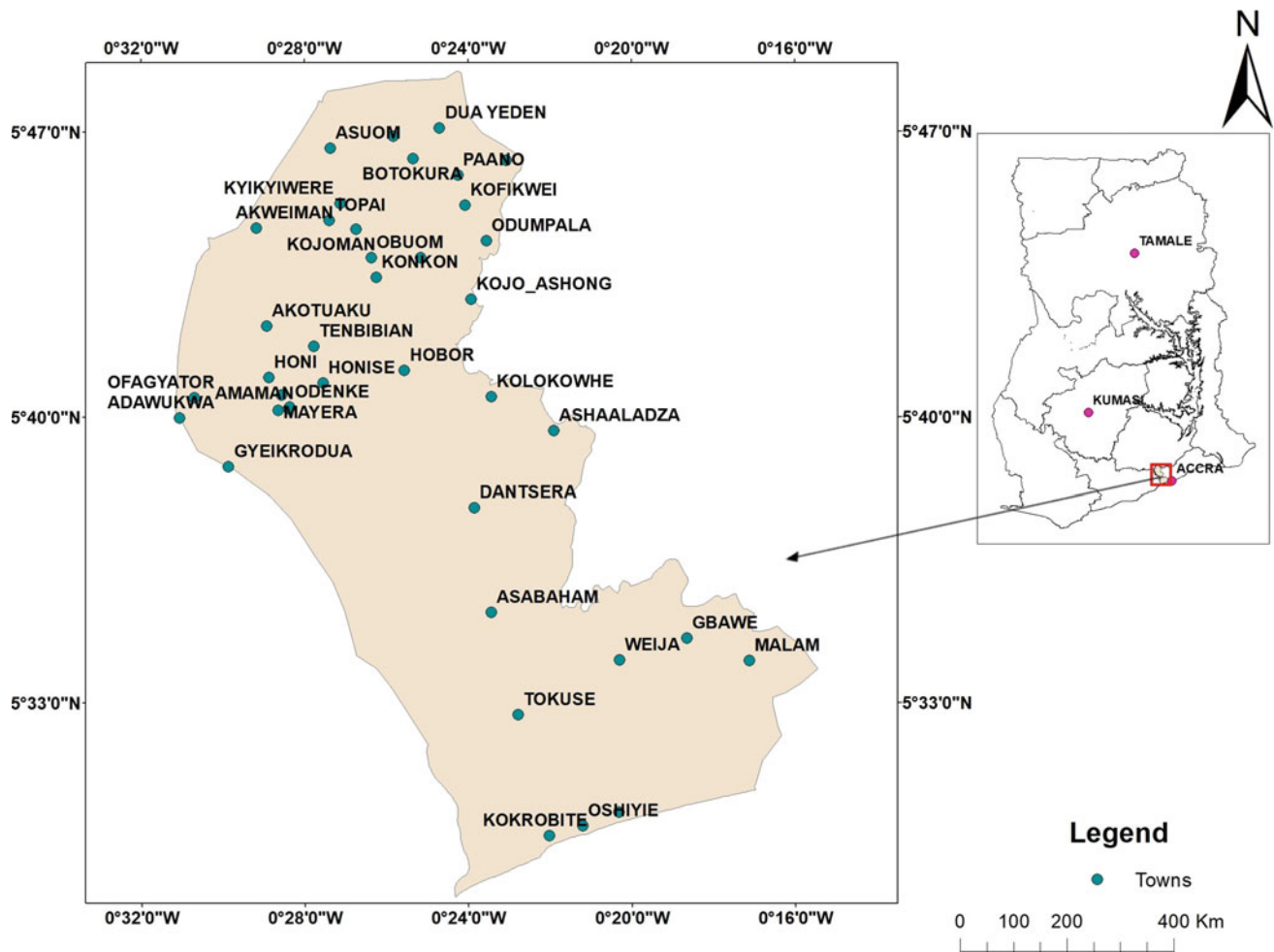


Fig. 1 Map of the study area

2 Materials and Methods

Questionnaires were administered by staff of GAEC and NADMO. Residents who could not read were assisted. The elite completed the questionnaires themselves. Three days

were allotted for the interview as indicated in Table 2 at Awutu Senya East and Weija-Gbawe Municipalities, respectively.

A total of two hundred and twenty-one (221) residents in the area were interviewed. There were divergent views from the inhabitants on their perception, experiences and adaptation strategies to earth tremors in the area.

Table 2 Earthquake occurrence and observation survey in the Awutu Senya East and Weija-Gbawe Municipalities

	Awutu Senya East Municipality	Weija-Gbawe Municipality
Day 1	Introductory visit to the National Disaster Management Organization (NADMO) office Planning of fieldwork, locations and schedule of personnel to administer questionnaire	Introductory visit to the National Disaster Management Organization (NADMO) office Planning of fieldwork, locations and schedule of field personnel
Day 2	Training of NADMO staff on seismic events and questionnaire administration	Training of NADMO staff on seismic events and questionnaire administration
Day 3	Administration of questionnaires and interview session	Administration of questionnaires and interview session
	Ninety-seven questionnaires were administered	One hundred and twenty-four questionnaires were administered

Through the briefing and interview sessions, the realization was that:

- Most of the people were aware that they live in an earthquake prone area but had no measures put in place to mitigate it in any form.
- The agencies and institutions responsible for permitting and regulating building activities in the area do not emphasize the need for geophysical investigation of their sites before development.
- There is the need to involve the chiefs and opinion leaders, real estate developers and the people themselves in the mitigation process since they are the custodians of the land.

minimize the risks posed by some of these natural disasters that can strike the area. Seismologists have warned that the continuous earth tremors should not be taken for granted. As a precautionary measure, it is recommended that all residents of the earthquake prone areas should seek professional advice for a seismic and geotechnical evaluation of the sites where their structures are located in order to determine the hazards and possible solutions.

The Geological Survey Authority is mandated to monitor seismic activities in the country and advice accordingly. This is supported by other agencies such as the National Data Centre of the Ghana Atomic Energy Commission.

For Ghana to become resilient to natural, manmade and technological hazards, we must be proactive in our planning and development strategies.

3 Discussions

During the interview session, it was observed that most of the inhabitants are aware that the area is prone to earthquakes but have no other place to move to, so they have decided to live with the menace. Others were ignorant and felt it was a common occurrence, so it did not bother them much. There is, therefore, the need for the responsible government agencies to conduct geological and geophysical investigation on every land acquired before releasing them to developers. There should be intensive and consistent public awareness creation on the need for geophysical investigation on all sites before development.

4 Conclusions

It is important to recognize that the southern part of Ghana has the highest concentration of strategic assets and human population. Therefore, strategies must be devised to

References

- Akoto, M.A., Anum, S.A.: Monitoring recent microseismic activity in Ghana. *Tectonophysics* **209**(1–4), 43–46 (1992)
- Amponsah, P.E.: Seismic activity in relation to fault systems in southern Ghana. *J. Afr. Earth Sci.* **35**, 227–234 (2002)
- Amponsah, P.E.: Seismic activity in Ghana: past, present and future. *Ann. Geophys.* **47**(2/3), 239–543 (2004)
- Amponsah, P.E., Leydecker, G., Muff, R.: Earthquake Catalogue of Ghana for the Time Period 1615–2003 with Special Reference to the Tectono-Structural Evolution of South-East Ghana. *J. Afr. Earth Sci.* **75**, 1–13 (2012)
- Bacon, M., Banson, J.K.A.: Recent Seismicity of Southeastern Ghana. *Earth Planet. Sci. Lett.* **44**, 43–46 (1979)
- Bondessen, E., Schmidt, A.F.J.: Holocene tectonic activity in West Africa dated by archaeological methods: Discussion. *Geol. Soc. Am. Bull.* **83**, 1193–1196 (1972)
- Doku, M.R.S.: Seismological and Geological investigation for Earthquake hazard in the Greater Accra Metropolitan Area. MPhil theses, University of Ghana, Legon (2013)
- Sykes, R.L.: Intraplate seismicity, reactivation of pre-existing zones of weakness, alkaline magmatism and other tectonism postdating continental fragmentation. *Rev. Geophys. Space Phys.* **16**(4), 621–682 (1978)