SCHOOL PREPAREDNESS AND TRAINING FOR GEOLOGICAL HAZARD MITIGATION: AN EXAMPLE FROM INDONESIA

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ABSTRACT
Indonesia is located in a region highly prone to geological hazards due to its position on the convergence zone of three different tectonic plates. The convergence zone of the Indo-Australian plate and the Eurasian plate extends along the west coast of Sumatra Island and is marked by the Sunda Arc and the Sumatra Fault, with high levels of seismicity and volcanic activity. One lesson learnt from the Tsunami that struck Aceh Province on 26 December 2004 and caused massive-scale destruction and loss of lives (mostly women and children), is that understanding the various vulnerabilities of the Indonesian society, raising awareness of geological hazard exposition, and educating school children in disaster preparedness and response plays an important role for disaster mitigation. Building disaster resilience is an essential but challenging task for the Indonesian Government. To raise and maintain awareness, not only of the public, but also institutional wise is a challenge for national and local governments in Indonesia. In order to cope with these challenges, the Indonesian government works with the German Federal Institute for Geosciences and Natural Resources (BGR) in a development cooperation project. The so called "Geomobil" is a mobile education and training facility which tackles playful capacity building for geological hazards in schools. It is one example of preparedness and awareness raising, managed by the Provincial Department for Mining and Energy of Aceh. The Geomobil regularly conducts visits to elementary schools throughout the province accompanied by professionals. Using theoretical and practical learning elements, pupils are enabled to understand the existing geological hazards and train how to safeguard themselves. This best practice example from Indonesian governmental institution shows how important effective information and training concepts are to build resilience within the society.
Keywords: geological hazards, awareness raising, preparedness, mitigation, training, Geomobil, school, tsunami.

1 INTRODUCTION

Indonesia is located at a tectonically highly active zone as a result of the confluence of three large plates. Those three large plates are the Eurasian, the Indo-Australian and the Pacific plates, which are parts of the world's so-called ring-of-fire. The confluence of these plates (subduction zone) starts from the west coast of Sumatra to the southern coast of Java to the west part of Sulawesi and from the north of Papua to the east of Mindanao (Fig. 1). The interactions between these plates causes the territory of Indonesia to be at risk of geological disasters. Referring to the geographical location of Indonesia, earthquakes, volcanic eruptions and tsunamis are common hazards in Indonesia. Especially during the rainy season, also small to medium size landslides accumulatively cause tremendous damage of infrastructure and loss of life, which add to the severe large scale geo-hazards occurring regularly. Aceh is one of the provinces in Indonesia which is prone to geological disasters, since it is located right at the Sunda Trench in northern Sumatra, the subduction zone of the Eurasian and the Indo-Australia plates. Aceh is also traversed by 'The Great Sumatran Fault' that divides the island of Sumatra from Teluk Semangko to Banda

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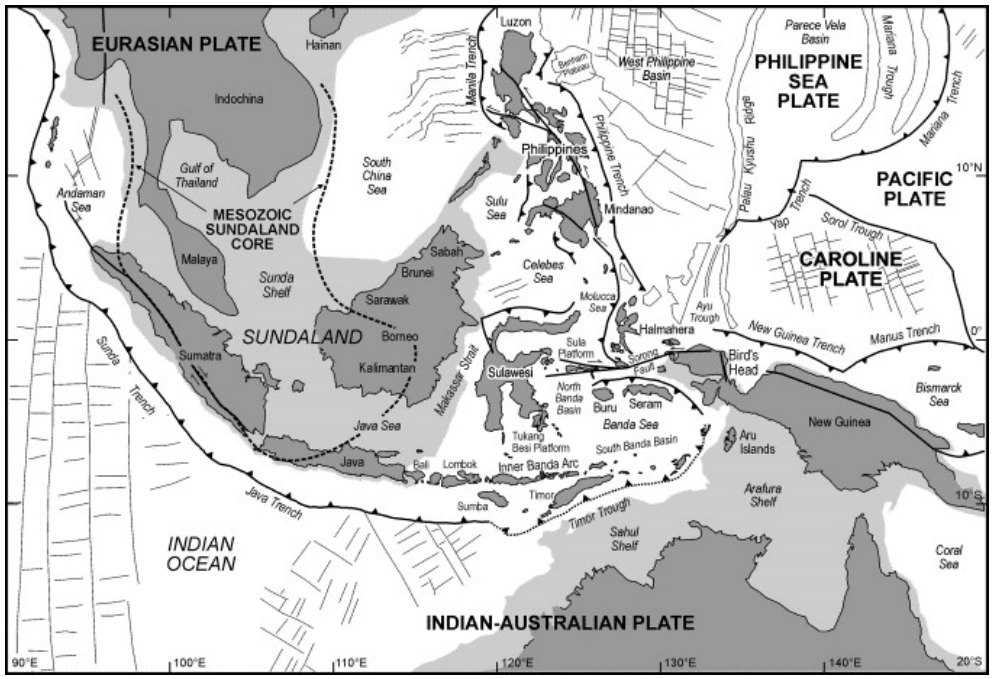

Figure 1: Principal geographic features and plate boundaries [2].

Aceh. This great fault extends to the Andaman Sea and Burma. This active fault is expected to shift about 10–25 millimeters per year [1] and hence is one of the regions prone to earthquakes and landslides.

The impacts of this tectonic structure, the volcanic activity and relative young geology in Indonesia can be divided into positive and negative impacts. The positive impacts include fertile soils, beautiful scenery, hydrocarbon basins, mineralization zones and huge renewable (geothermal) energy potential. These positive impacts encourage resource exploitation for public welfare. The negative impacts include geological disasters such as earthquakes, tsunamis, volcanic eruptions and landslides. It has prompted the necessity to address risk mitigation to reduce geological disasters.

The earthquake and tsunami on 26 December 2004 with a magnitude of 9.2Mw, which occurred near the west coast of Aceh and triggered a tsunami in the Indian Ocean, might be considered a wake-up-call for affected South-East Asian and South Asian countries to address tsunami risk in a multidisciplinary fashion. The large number of fatalities with more than 250,000 victims throughout Asia and Indonesia bearing the brunt of it [3] making it the deadliest single event in recent history [4]. In Indonesia, the tsunami showed that especially children, women and elderly people are prone to the adverse effects of geological hazards and that reducing their vulnerability, among others is necessary to create resilient communities [5].

The tsunami disaster in 2004 was followed by the revision of a number of laws and the establishment of a new institutional setup in the governmental system of Indonesia in regard to the legal-institutional framework for disaster risk management (DRM) [6].

Developing policies and DRM institutions alone is not enough and Indonesia is still struggling with effective implementation, especially at the local government level [7].

One of the causes for the great loss of life and property in Indonesia, especially in Aceh during the earthquake and tsunami in 2004, was the lack of public awareness of natural hazards and disaster mitigation. To avoid similar outcomes happening again, there is a need to improve awareness of the whole society to understand and master disaster mitigation. One of the objectives is to increase public awareness so people can live and work safely. In order to create a strong society, increasing of risk awareness and education for all societal levels is necessary as a continuous task for the government.

2 GEOLOGICAL HAZARD MITIGATION

Over the last five years (2011–2016), geological disasters occurred in several areas in Aceh mostly in the form of earthquakes and landslides. As of the end of December 2016, fifty-one (51) geological disasters were recorded [8]. The record shows that landslides make up as much as 65%, while earthquake contribute to 35% (Fig. 2). As a result of these disasters, 161 people died.

The Department of Mining and Energy (Distamben) of Aceh Province is one of the local government agencies in Indonesia that handles geological disaster mitigation from analysis, development of mitigation measures to public education. Strategies in geological disaster mitigation currently implemented include the identification of the disaster potential, the increasing of public awareness and coordination for disaster risk reduction.

3 AN EXAMPLE FROM INDONESIA: GEOMOBIL

Aceh province is one of the worst areas hit by the tsunami in 2004. The analysis of that disaster showed that most of victims at the time were children, women and elderly people. Given the aforementioned fact, it is clear that increasing public awareness, especially for school children, is a very important task of the government contributing to building disaster resilience.

Distamben Aceh through the local Geology Department is an intermediary institution between public authorities and the community, translating scientific information into educational material that is easy to understand for different education levels. One of the steps towards a disaster-resilient community is the creation of a strong young generation and the implementation and improvement of the best learning concepts in the field of awareness raising and technical training.

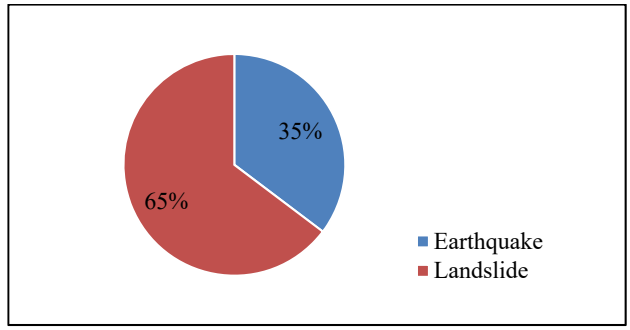

Figure 2: The percentage of geological disasters in Aceh in 2011–2016 [8].

The Geology Department of Distamben Aceh has the task to socialize the mitigation of geological disaster and to disseminate the information of geological hazards to government officials at the district, sub-district and village levels. In addition, the dissemination of such information to the general public is also the task of the local Geology Department. According to the needs they translate the latest scientific advancements into easily understandable materials to create geological hazard awareness. To address the special needs of school children, this has been implemented with the so called "Geomobil". The Geomobil is a public service innovation to build knowledge and awareness of disasters, especially for school children and is conducted by the local Geology Department team of Distamben Aceh.

3.1 Schools preparedness with Geomobil

The Geomobil consists of a specially equipped minibus which has been modified to meet the educational purpose (Fig. 3). It includes a mobile mini-library, various teaching materials, games, disaster simulation equipment, audio-visual equipment for video playback. It is accompanied by a professional team that teaches students how to minimize the risk of geological disasters in an interesting, fun and easy-to-understand way using different educational techniques.

Geomobil main activities are school visits. By actively visiting the children in their respective school environment, Geomobil is able to reach the target group more easily. The on-site visits also utilize the school surrounding for training purposes. Usually all students and teachers actively participate in the activities. First, the facilitator team delivers theoretically some geological basics (plate tectonics and geography of Indonesia). They learn about geological hazards, especially the ones that exist in their neighborhood. As volcanic activity is known to almost every child in Indonesia, a simple experiment using soda and baking powder illustrates an eruption. Second, the school team practices personal safety behavior and exercises an evacuation drill. The combination of activities ranging from classroom lessons with experiments (Fig. 4), to outdoor activities (Fig. 5) is very important to account for the limited concentration timespan.

Figure 3: The Geomobil of Distamben Aceh.

Figure 4: Classroom experiments and mobile library.

Figure 5: Earthquake safety exercise and evacuation drill for primary school.

Due to the often-large number of students per school, the geologist team of Distamben Aceh collaborates intensely with the school teachers. Despite the fact that education on natural hazards is included in the school curriculum [9], teachers often follow the Geomobil program very carefully, as their knowledge base on these topics is often very limited and therefore implementation of the curriculum is lacking.

3.2 Implementation of Geomobil

Most schools visited by the Geomobil Team are elementary schools, which facilitate activities for all students. The priority of Geomobil are schools and areas with a high potential of geological disasters. Geomobil visit can also be requested by teachers and the schools themselves.

Geomobil activity first started in 2006 after the Aceh Tsunami, and was one result of the collaboration between the Department of Mining and Energy of Aceh Province and the ManGeoNAD Project, implemented by the Federal Institute for Geosciences and Natural Resources (BGR, Germany). Since 2014, Geomobil has been supported by the Georisk-Project, including the promotion of using new media for the various education sessions. To ensure economic sustainability and proper budgeting, a business plan has been developed as well. So far funding for consumable materials has been a major bottleneck. Geomobil program is still supported by the German-Indonesian Development Cooperation, implemented by the Federal Institute for Geosciences and Natural Resources.

3.3 Results and outlooks

The public perception of and response to Geomobil activities is very positive, mainly because of its interactive approach. Each student can be involved in a practical way by using a variety of teaching methods and language suitable for children. The interactive approach, which uses simulations, exercises and games, helps to disseminate information and targets to improvement disaster response (Fig. 4). Geomobil success is also visible by the large number of requests from individual principals, school advocacy groups and teachers.

Since 2006, Geomobil activity has reached over 60 schools in the Province of Aceh and one school in the province of Nusa Tenggara Timur, and has educated more than 4200 children in the age between 7 to 15 [7].

With additional funding, the scope of Geomobil activity could be continuously improved. A business plan that analyses the current situation and future challenges with the help of a SWOT analysis (Strengths, Weaknesses, Opportunities and Threats) shows that Geomobil is an approach that is consistent with the goals and needs in the Aceh Province [7]. The finding of that business plan also shows the benefit of any investment to acquire additional funds for Geomobil.

The transfer of this successful example to other regions can take advantage of the (new) national government's desire to raise awareness and to educate the public. On the national level, the Human Resource Development Agencies of the Energy and Mineral Resource Ministry have collaborated and performed comparative studies with Distamben Aceh for the development of Geomobil activities in other parts of Indonesia as well.

4 CONCLUSIONS

Public authorities at the local government level are an important mediator between scientific hazard information and the public, while increasing hazard awareness and disaster mitigation targeting school students is important because they are considered especially vulnerable.

Geomobil is an effective tool in Aceh to achieve higher levels of awareness and disaster education. However, the relationship between the public education sector and the service of the local government as a mediator in the field of information on geological disasters is still not recognized enough.

Geomobil is a positive example of proactive involvement of authorities in the field of geology in increasing awareness, which indicates that the transfer of knowledge in a professional manner to the community is very helpful. It also shows how scientific knowledge can be transferred to adequate educational material for children. A replication to other provinces in Indonesia or even support awareness raising through social media and open learning systems will be an interesting perspective for the future.

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