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# TABLE OF CONTENTS

Cover Page.............................................................................................................i  
Foreword..................................................................................................................ii  
Message from Head of Geological Engineering Department-UGM..........................iii  
Table of Contents .....................................................................................................iv  

## EARTH RESOURCES TOPICS

| ER01 | Granitic Magmatism in Sulawesi Island, Indonesia; Implication for Metallogenic Province  
Maulana, A., Watanabe, K., Yonezu, K., and Imai, A., ..............................................2 |
| ER02 | Relationship Between Granitoid Types and Tin Mineralization: A Review Of Tertiary Granitoids in Central Granitoid Belt, Myanmar  
Myint, A.Z., Watanabe, K., and Yonezu, K., ...............................................................13 |
| ER03 | Geochemistry and Alteration Facies Associated with High-Sulfidation Epithermal Mineralization At Cijulang Prospect, Garut, West Java  
| ER04 | Potential of Primary Gold Mineralization Within The Upper Sungai Galas Prospect, Gua Musang, Kelantan, Malaysia  
Ariffin, K.S., Nakamura, K., Takahashi, R., Cheang, KK., and Zabidi, H.M., ..........................................................34 |
| ER05 | Jadeite Jade from South Sulawesi in Indonesia and Its Geological Significance  
Setiawan, N.I., Osanai, Y., Nakano, N., and Adachi, T., .............................................40 |
ER06 Magnetic Susceptibility and Mineral Exploration: Case Study of Granitic Rocks in Cambodia
Kong, S., Watanabe, K., and Imai, A., ....................................................... 57

ER07 Geostatistics Model for Original Gas in Place (OGIP) Estimation
Muchalintamolee, N., Udomlaxsananon, P., Sunmpapo, S.,
and Punjan, S., ................................................................. 63

ER08 Sphalerites’ Mineral Chemistry and Sulphidation State of Polymetallic Epithermal Quartz Veins at Soripesa Prospect Area, Sumbawa Island, Indonesia
Khant, W., Warmada, I.W., Idrus, A., Setijadji, L.D., and Watanabe, K., ....... 70

ER09 Ore and Alteration Mineralogy of Muara Bungo Gold Prospect, Jambi Province: Implication for Deposit Genesis
Hakim, F., Idrus, A., and Sanjaya, I., ................................................................. 80

ER10 Characterization of Maar Deposits from Ranu Segaran, Ranu Agung and Ranu Katak, as Well Magmatic Evolution that Form Maar Eruption in Tiris District, Probolinggo Regency, East Java
Prakosa, B.B., Harijoko, A., and Warmada, I.W., ......................................................... 87

ER11 Ore and Alteration Mineralogy of Paningkaban-Cihonje Gold Prospect, Gumelar Sub-District, Banyumas Regency, Central Java: A New Discovery of Carbonate Base Metal Gold Epithermal Deposit
Idrus, A., Hakim, F., Kolb, J., Appel, P., and Aziz, M., ............................................. 100

ER12 Progress on Rare Earth Elements (REE) Research in Indonesia 2008-2013
Setijadji, L.D., Warmada, I.W., Yonezu, K., and Watanabe, K., ......................... 113

ER13 The Dioritic Alteration Model of The Randu Kuning Porphyry Cu-Au Ore Deposit, Selogiri Area, Central Java, Indonesia
EXPLORATION GEOSCIENCES TOPICS

XG01 Potential Use of Synthetic Aperture Radar (SAR) Data for Geothermal Exploration
Saepuloh, A.,.................................................................132

XG02 Sedimentary Facies of Middle Miocene Balikpapan Formation, Samarinda Area, Lower Kutai Basin, Indonesia
Win, C.T., Surjono, S.S., Amijaya, D.H., Husein, S., Watanabe, K., and Astuti, B.S.,.................................................................139

XG03 “Unconventional Reservoir” Shale Gas Potential Based on Source Rock Analysis in Sumatran Back Arc Basin
Wibowo, R.C.,.................................................................151

XG04 Facies Analysis and Depositional Environments of The Ngrayong Formation in The West Madura Area, North-East Java Basin, Indonesia

XG05 DHI Skimming, A Proposed Seismic Interpretation Technique for Quick Reading on Speculative Hydrocarbon Fields
Zulfiadli, Surjono, S.S.,.................................................................177

XG06 Inversion Analysis of AIGI in Seismic Data for Hydrocarbon Identification in Sandstone Reservoir, Case Study in Mustika Field, Kutai Basin, East Kalimantan
Asrim, Nugraha, T., Wintolo, D., and Setyowiyoto, J.,.................................................................187

XG07 Relationship Between Rock Eval Pyrolysis Data and Abundance of Liptinite Macerals in Shale of Talang Akar Formation, South Sumatera Basin
Novianti, W., and Amijaya, D.H.,.................................................................203
ENVIRONMENTAL GEOSCIENCES TOPICS

EG01 Estimation of Strong Ground Motion in Palu, Indonesia
Thein, P.S., Pramumijoyo, S., Brotopuspito, K.S., Wilopo, W.,
Kiyono, J., and Setianto, A., .................................................. 211

EG02 Seismic Microzonation of The Populated Urban Area Using Densely
Single Microtremor Observations [Case Study: Yogyakarta City-
Indonesia]

EG03 Investigation and Assessment of The Earthquake Hazards in Myanmar:
Background, Characterization, Causes, and Mitigation Measures
Kham, N.M., and Htun, K., ................................................................ 241

EG04 Development of Seismic Microzonation Maps of Mandalay City,
Mandalay Region, Myanmar
Thant, M., Mon, C.T., Tin, T.H., Oo, K.K.K., Aung, L.T., Win, Z.M.,
Tun, N.T., Soe, M.Y., and Kawase, H., .............................................. 258

EG05 A Sustainable Solution to Disposal Problem of Mine Tailings
Adajar, M.A.Q., and Zarco, M.A.H., .................................................. 274

EG06 Shoreline Changes and Its Influence for Level of Coastal Vulnerability

GROUNDWATER AND HYDROGEOLOGY TOPICS

GH01 The Type of Water in Spring Water Hydrogeochemistry in The Eastern
Flank of Mount Merapi, Boyolali and Klaten District, Central Java,
Indonesia
Santi, N., Hendrayana, H., and Putra, D.P.E., ....................................... 299
Proceedings of International Conference on Geological Engineering  
Geological Engineering Department, Engineering Faculty, Gadjah Mada University  
December, 11-12 2013

GH02 Determination of Suitable Groundwater Quality for Agriculture by Using Gis Application, Bantul Regency, Yogyakarta Special Province, Indonesia  
Kong, C., Hendrayana, H., and Setianto, A., .................................................. 304

GH03 Study on River Morphology, Gravel-Sand Depositions and Tests for Civil Engineering Purposes, Case Study River Nam Ma, Xiengkhor, Ad and Sop Bao Districts, Houaphanh Province  
Visane, N., Sitha, and Phommasone ............................................................ 317

LANDSLIDE SUSCEPTIBILITY TOPICS

LS01 Development of A Rapid Condition Assessment Tool for Landslide Susceptibility in The Philippines  
Victor, J.A.S., and Cristobal Jr, R.A., .................................................................. 331

LS02 Community Empowerment Program of Landslide Hazard in Sepanjang Village  
Yanto, E., Andaru, A., Rudianto., Indrawan, I.G.B., and Wilopo, W., .............. 345

ROCK MECHANICS TOPICS

RM01 Piles Foundation in Phnom Penh Capital of Cambodia  
Sieng, P., ........................................................................................................... 352

RM02 Strengthening Soft Soil by Electro-Kinetic Method Case Study Clayey Soil From Ngawi Regency, East Java, Indonesia  
Thuy, T.T.T., Putra, D.P.E., Budianta, W., and Hazarika, H., ........................... 371

RM03 Numerical Study of Storage Capacity and Potential Ground Uplift Due to CO2 Injection Into Kutai Basin by Using Coupling Hydromechanical Simulator  
Arsyad, A., and Samang, L., .............................................................................. 382
SAFETY MANAGEMENT
SM01 Threat, Hazard, Risk and Vulnerability Assessment of Merapi Volcano in Yogyakarta, Indonesia
Brunner, I.M.I.M., and Setianto, A., ................................................................. 392

STRATEGIC DEVELOPMENT ON MINERAL RESOURCES TOPICS
SD01 Strategies for Sustainable Mining: A Case of Lead (Pb) Mining in Thailand
Boonpromote, T., ......................................................................................... 402

MINERAL PROCESSING TOPICS
KS02 Soil Reinforcement Using Calcium Phosphate Compounds
Kawasaki, S., and Akiyama, M., .................................................................. 412

MP01 Hydrometallurgical Process for Poor Zinc Oxide Ores
Dang, V.H., Dang, T.V., ............................................................................... 422

MP02 The Influence of Coal Ash Content Relating to Slagging nd Fouling on Its Utilization as Direct Combustion
Gany, M.U.A., .......................................................................................... 430

MP03 Precursors of Coal in The Kutai Basin, East Kalimantan, Indonesia: Result From Gas Chromatography Mass Spectrometry
Widodo, S., .............................................................................................. 436

INDUSTRIAL MINERALS TOPICS
IM01 Carbon Dioxide Mineral Sequestration by Using Industrial Waste Gypsum
Junin, R., Rahmani, O., and Azdarpour, A., .................................................. 451
THREAT, HAZARD, RISK AND VULNERABILITY ASSESSMENT OF MERAPI VOLCANO IN YOGYAKARTA, INDONESIA

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Abstract

Merapi, the most active volcano in Indonesia, sits on the northern part of Yogyakarta province where about 1.5 million residents live. In 2006 short after eruption, Merapi area was hit by a 5.9 magnitude earthquake that destroyed the Yogyakarta’s natural barrier, known as Geger Boyo. The pyroclastic flow threat from Merapi becomes more imminent ever since. The Merapi eruption in 2006 and 2010 also brought up social drama when a local key person with several of his followers rejected the government’s evacuation mandatory. Those occasions could happen because the government who rely more on technological equipment failed to build effective communication with the local community. The government with an obligation to save people live have a tendency to give direct orders that need to be obeyed. On the other hand, local community has their own wisdom in dealing with the event, which could be more influential for them.

The paper attempts to discuss some improvements that could be done in understanding the Merapi area by adding several factors attributing to the local wisdoms. Those factors include: land attachment, local knowledge and beliefs, local leader’s influence, and local conventions. The challenge is to inventory, to identify, and then to spatialize those local wisdoms. These will lead to the creation a new vulnerability map which includes local attributes. It is hope that the risk map as a resultant of vulnerability and hazard maps would give information regarding local wisdom.

Key words: Merapi, Yogyakarta, Local Wisdoms, Spatial Analysis, Vulnerability Map

Introduction

Merapi is one of the most active volcanoes in Indonesia and has produced more pyroclastic flows than any other volcano in the world, it's situated at Kabupaten Sleman-Provinsi Central Java and has been active for 10,000 years. In 2004 an area of 6,410 hectares around Mount Merapi was established as a national park by decision of the Ministry of Forestry. During the 2006 eruption of the volcano it was reported that many residents were reluctant to leave because they feared their residences would be confiscated for expanding the national park. Merapi volcano began erupting on 26th October 2010. Ash emissions reached an altitude of 7.5 km, and over 350 people were killed by pyroclastic flows and ashfall. Most eruptions of Merapi involve a collapse of the lava dome creating pyroclastic flows which travel 6 to 7 km
from the summit. Some hot ashes have traveled as far as 13 km from the summit, such as the deposit generated during the 1969 eruption. Velocity of pyroclastic flows can reach up to 110 km/hour. A slow up flow of andesitic magma leads to an extrusion of viscous magma, which accumulate and construct a dome in the crater Merapi. Widespread pyroclastic flows and surges traveled up to 25 km down the flanks of Merapi. On 5 November Merapi volcano experienced its largest eruption since it commenced activity on 26 October 2010. The Volcanology and Geological Disaster Mitigation Center (PVMBG) and local government authorities have decided to widen the evacuation zone around the volcano from 15 to 20 kilometres from the crater. On 3 December 2010, BNPB and PVMBG made a joint press release that as of 3 December 2010, at 09.00 am lowered the status of Mount Merapi to the level of "Caution Alert" (Level III). They clarified that with this alert level the potential of hot ash clouds and projected incandescent material remained. The Geological Agency provided several recommendations including that there would be no community activities in the disaster prone areas and proclaimed an ongoing exclusion zone of 2.5 kilometres radius. PVMBG then produced a identified: Potentially affected by lava or stream flow (flood) and possibly affected by overflowing of pyroclastic flows; Potentially affected by pyroclastic flows, toxic gasses, glowing rock falls and lava and; Frequently affected by pyroclastic flows, lava flows, rock flows, rock falls, toxic gasses and glowing ejected rock fragments.

![Figure 1. The historical distribution of pyroclastic flows on Merapi slope](image.png)
(adapted from Lavigne, T., et al. 2000; Kaye, W., et al. 2007)
Table 1. Impact of 2010 Mt. Merapi eruption (http://www.bnpb.go.id)

<table>
<thead>
<tr>
<th>Name of regency</th>
<th>Province</th>
<th>Number of victims</th>
<th>Volcanic process as the destroyer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleman</td>
<td>Yogyakarta</td>
<td>243</td>
<td>203</td>
</tr>
<tr>
<td>Klaten</td>
<td>Central Java</td>
<td>36</td>
<td>30</td>
</tr>
<tr>
<td>Magelang</td>
<td>Central Java</td>
<td>52</td>
<td>96</td>
</tr>
<tr>
<td>Boyolali</td>
<td>Central Java</td>
<td>10</td>
<td>37</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>341</td>
<td>336</td>
</tr>
</tbody>
</table>

Figure 2. Distribution of major deposit from concentrated flows and dilute surges of recent eruption at Merapi (Jenkins, S., 2011)

Culture in Mt. Merapi and the Surrounding Area

Merapi continues to hold particular significance for the Javanese beliefs: it is one of four places where officials from the royal palaces of Yogyakarta and Solo make annual offerings to placate the ancient Javanese spirits. To keep the volcano quiet and to appease the spirits of the mountain, the Javanese regularly bring offerings on the anniversary of the sultan of Yogyakarta’s coronation. For Yogyakarta Sultanate, Merapi holds significant cosmological
symbolism, because it is forming a sacred north-south axis line between Merapi peak and Southern Ocean (Indian Ocean). The sacred axis is signified by Merapi peak in the north, the Tugu monument near Yogyakarta main train station, the axis runs along Malioboro street to Northern Alun-alun (square) across Keraton Yogyakarta (sultan palace), Southern Alun-alun, all the way to Bantul and finally reach Samas and Parangkusumo beach on the estuary of Opak river and Southern Ocean. This sacred axis connected the hyangs or spirits of mountain revered since ancient times - often identified as "Mbah Petruk" by Javanese people - The Sultan of Yogyakarta as the leader of the Javanese kingdom, and Nyi Roro Kidul as the queen of the Southern Ocean, the female ocean deity revered by Javanese people and also mythical consort of Javanese kings.

Methodology

The 2006 and 2010 events showed us the drama when a local key person with several of his followers rejected the government’s evacuation mandatory. Those occasions could happen because the government who rely more on technological equipment failed to build effective communication with the local community. The government with an obligation to save people live have a tendency to give direct orders that need to be obeyed. On the other hand, local community has their own wisdom in dealing with the event, which could be more influential for them.

The idea is to improve the current disaster management practices especially that relates to Merapi. The improvement could be done by acknowledging several factors attributing to the local wisdoms, such as:

a. Land attachment.
   The highest priority for the government is to save as many human lives as possible. Nonetheless, for some villagers, evacuation process without evacuating their cattle with them is not preferable. The villagers could reject the evacuation orders or at the least they would go back to their village in the hazard area just to feed their cattle.

b. Leader’s influence.
   The case of Mbah Marijan in 2006 and 2010 could be used an indicator of the existence of leader’s influence.

c. Local conventions.
   Most people in Yogyakarta are familiar with the traditional communication tool, known as kentongan, to relay information to the next village. The kentongan is made of bamboo that has a hole in the middle. Striking the kentongan in different repetition has various meaning.

The challenge is to inventory, to identify, and then to spatialize those local wisdoms. These will lead to the creation a new vulnerability map which includes local attributes. It is hope that the risk map as a resultant of vulnerability and hazard maps would give information regarding local wisdom.
Tabel 2. Striking the *kentongan* in different repetition and the various meaning.

<table>
<thead>
<tr>
<th>Repetition</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>Raja Pati</em> (passed away)</td>
</tr>
<tr>
<td>● ● ● ● ● ●</td>
<td><em>Ana Maling</em> (robbery)</td>
</tr>
<tr>
<td>● ● ● ● ● ●</td>
<td><em>Omah Kobong</em> (fire)</td>
</tr>
<tr>
<td>●●●●●●●●●●●●</td>
<td><em>Banjir Bandang</em> (natural disaster)</td>
</tr>
<tr>
<td>●●●●●●●●●●●●</td>
<td><em>Maling Kewan</em> (animal thief)</td>
</tr>
<tr>
<td>●●●●●●●●●●●●</td>
<td><em>Doro Muluk</em> (Safe)</td>
</tr>
<tr>
<td>●●●●●●●●●●●●</td>
<td><em>Gobyok</em> (Alert)</td>
</tr>
</tbody>
</table>

**Traditional Rules**

The cultural environment may influence the behavior of the people and their perception of the risk (Lavigne, et al. 2008). Most of local community surrounding Merapi volcano believe that there is an invisible kingdom controls the volcanic activities of Merapi and it will not destroy its own land. Considering that the location of their villages are near the Kingdom, they suppose to be not afraid when the volcanic activities is rising (Yunus 1996). Local people think that volcanic eruptions are under the control of divine forces. The volcanic activities has been integrated in their daily life, it belong to the human world. Their belief on cultural environment is related with the cultural leader existence, called Juru Kunci (Key holder). Juru Kunci of the Merapi volcano is live in Kinahrejo hamlet, part of Pelemsari, one of the villages in the third level dangerous zone. He was appointed by the Sultan to carry out the annual gift to the volcano, called Labuhan to honor the founding father of the ancient kingdom. 58.8% of the respondents are giving their respect to the informal leader existence. People in the third level dangerous zone have highly respected to the cultural leader (93.33%).

In the second zone, 76.67% of people are respecting to informal leader, and 23.3% are not. In the safest zone, the cultural leader existence related with volcanic events has no interesting. 13.33% people are respecting to informal leader, and 86.67% are not. The reasons of people in the third zone giving the respect to the cultural leader are: (a) because of his relationship with Sultan (37%), (b) because of their ancestor’s belief (37%), (c) because of his heredity (23%), and (d) no reason (3%) (Rianto, 2009).

The devastating eruption of the Merapi volcano which began on 28 October 2010 has displaced practitioners of intangible cultural heritage of the area surrounding the mountain. One great maestro of the knowledge of nature and traditions who resided in the surrounding
area of the volcano, lost his life at 5am that morning while bowing in prayer to Mbah Marijan, the elderly and much respected 'gatekeeper' of the volcano. One of the duties of Mbah Marijan's is to make thrice annual traditional offerings to the Merapi volcano (labuh) on behalf of Sri Sultan Hamenkubuwono X. In addition to rehabilitating those displaced by this disaster, the government of Yogyakarta in collaboration with the central government, are also taking measures to safeguard the intangible cultural heritage of the surrounding area, which has been displaced and disrupted by the disaster.

Figure 3. Response to the question: Are you respecting to informal leader? (Rianto, T., 2009)

Figure 4. The reason to respect (Rianto, 2009)
In actions to safeguard tangible and intangible cultural heritage might include:

1. Taking note of local genius which might help to anticipate natural disasters, minimize the damage they cause, and to rehabilitate in the aftermath.
2. Identifying practitioners of intangible cultural heritage displaced by disasters, and assisting them to get back on their feet and continue to make a livelihood by practicing their particular handicrafts or performing arts, and transmitting their heritage to the younger generations.
3. Repair and safeguarding of museums, libraries, galleries, traditional schools and other repositories of cultural heritage which might have been damaged.
4. Involvement in arts and cultural activities can be used to ease post-disaster trauma, particularly for those who have lost family members.

In addition to modern seismic methods of detection, traditional wisdom has shown relevant in giving predictions and warnings of upcoming disasters. Local beliefs have helped people come to terms with what happened and to resume their lives after the unfortunate disasters.

**Participatory GIS Approaches**

The importance a community places on the risk of a disaster is likely to be influenced by the type and level of other everyday risks it faces. Community-based disaster management is empowering communities to assess disaster risks, and to plan, implement, monitor and evaluate counter disaster measures. They take responsibility for their action and are accountable for resources they utilize. Participation is a central issue within the field of development cooperation since 1990s. Participatory is defined as a partnership which is built upon the basis of dialogue among the various actors. In this concept, local views and indigenous knowledge are deliberately sought and respected. People become actors instead of being beneficiaries (UNDP 1998).

Generally, participation can be understood as the active involvement of people in making decisions about the implementation of processes, program, and projects that affect them. Community participation is being encouraged in many areas of development, including disaster management because of some reasons. First, participatory approach enables people to explain their vulnerability and priorities to be designed and implemented. Second, people and their local knowledge and expertise are the principle resources for mitigating to disasters. Third, participatory work obtains a multi-track approach, combining different activities that dealing with the complexity of disasters. The process of achieving things together can strengthen communities and increases the potential of the people for reducing vulnerability. Fourth, participatory initiatives are sustainable because they build on local capacity, and likely to be compatible with long-term development plans. Fifth, participatory approaches in the long-term may be more cost-effective than externally driven initiatives. The external agents cannot cope alone with the enormous risks and they need local people to bring knowledge and skill. Finally, working with local community can help scientists to gain a greater insight, and produce better result (Tigg, 2004).

Spatial information plays a role in nearly all these phase. In disaster management, much type of data will be collected to arrange the best decision. In the aspect of disaster management that has an important spatial component, the data will be collected using remote
sensing and combined with other types of data using GIS. Here, GIS has important purposes in: data collection, data management, data analysis/modeling, and data dissemination.

Geoinformation science consist of a combination of tools and methods for the collection, storage, and processing of geo-spatial data. This involves the development and application of concepts for the structuring, organization, and management of geo-spatial production processes, the implementation of concepts for spatial data modeling, for information extraction from measuring on image data, and for the processing, analysis, dissemination, presentation and use of geo-spatial data (Westen, 2005).

Participatory Geographic Information Systems (PGIS) is an attempt to utilize GIS technology in the context of the needs and capabilities of communities that will be involved with, and affected by development projects and programs. PGIS is the crossing of participatory progressive development and GIS-science integrating low and high tech spatial management applications, and also seen as a practice which should facilitate empowerment (possessing own spatial information), communication among stakeholders and as learning processes (Kienberger 2008). McCall (2004) wrote that participation is the essence and the key to P-mapping and PGIS. The participation is more fundamental than the map or the GIS product. The spotlight always falls back on the participation and the participatory processes, rather than the GIS (McCall 2004).

Community Based Risk Management.

Risk reduction is a difficult prospect in the Merapi region. The volcano is one of the most active in the world. During the 20th century, eruptions of Merapi caused 1600 deaths, and tens of thousands more were injured, evacuated or made homeless. The impacts of eruptions have become increasingly more devastating because of the rapidly-growing population. An estimated 1.1 million people live on the slopes of Merapi, and the population growth rate was calculated as 3% annually in the mid-1990s. Java has one of the highest population densities in the world, imposing significant stress on its natural resources and leading to marginal and dangerous regions (such as the slopes of Merapi) being inhabited. Approximately 440,000 people live in high-risk areas subject to pyroclastic flows, surges and lahars from Merapi. The situation is exacerbated by the general lack of land-use planning. In summary, all available information points towards an increasing volcanic risk in the Merapi region.

Fortunately, risk readiness among vulnerable communities in the Merapi region was found to be very good. At an individual level, people had a good understanding of volcanic hazards, and were well-prepared for evacuations. Nearly all the people we spoke with had established an evacuation plan, either as part of their village evacuation plan or as an individual family plan. These plans included meeting points for family members if they were separated. When evacuations occurred, they were carried out efficiently. As an example, around 15,000 people were evacuated from Kaliadem village after the first block and ash flow at noon on 14 June, within a three-hour timeframe. The well-established social structure and clearly-defined leadership roles in rural communities were undoubtedly important in facilitating evacuations.

However, there are some problem areas. Economic pressures caused farmers to return to their farms in the exclusion zone during the daytime, and may also have caused other residents to refuse to evacuate altogether. The fact that supernatural beliefs about the volcano hold sway in this region may also contribute to this trend; people may put more faith in traditional beliefs.
(such as omens of an impending eruption) rather than scientifically-based warnings. The emergency management authorities may have also suffered setbacks to their credibility by lowering the alert level in advance of a major eruptive event (14 June block and ash flows); people returned to their homes but then had to be re-evacuated. The continuing uncertainty was a difficult situation for both the authorities and the local residents.

Conclusion

This study concluded that the experience of Merapi eruption related to people understanding to the eruption, emotional response, living in evacuation camp, positive and negative impact of disaster, and relocation plan as implication of Merapi eruption to people affected by it. In understanding Merapi eruption people perceive it as disaster and a blessing event. This understanding was based on their experience living with disaster, and level of severity. Despite any difficulties that they face after disaster, villagers still perceive the eruption in positive manner regarding the benefit that they will gain after the eruption. Perceiving situation after disaster in more positive manner made them have positive way of coping and able to handle difficulties after eruption.

Relocation to other area was rejected. This is related to the strong connection between the historical, population and environment of mount Merapi as a place to live. In relation to coping behavior and adjustment to situation after disaster, this research found the importance of finding meaning and explanation through defining the causes of disaster. This was one of the steps in the process of recovery and growth after eruption. This research also found there were strong connectivity between individual, community, environment, local wisdom and mount Merapi. This bond is important to understand the relation between individuals, communities, local wisdom and environments in explaining or giving meaning to experiences.

Spatial information plays a role in nearly all these phase. In disaster management, much type of data will be collected to arrange the best decision. In the aspect of disaster management that has an important spatial component, the data will be collected using remote sensing and combined with other types of data using GIS. Participatory Geographic Information Systems (PGIS) is an attempt to utilize GIS technology in the context of the needs and capabilities of communities that will be involved with, and affected by development projects and programs such as spatial mapping of land attachment, leader’s influence, local conventions.

References
