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CATATAN GEOLOGI (Geological Notes)

Seismicity of South East Asia: April – June 2005

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Abstract

This short note is a continuation of a previous article looking the seismicity of South East Asia using the National Earthquake Information Centre's web data. This time, the duration is from April till June 2005. As before, this study also focuses on magnitude and depth distributions, and how the seismicity is related to the tectonic features in the area.

The seismicity pattern during this period is similar to the seismicity from January to March 2005, with the exception of three events that were located on the Borneo Island. The major contributor to the seismicity of this area is still the activity near the site of M 9, December 26, 2004 earthquake. The area has remained dynamic and as mentioned previously, the activity is expected to continue in the next few months given the size of the quake. April has the most earthquakes, due to a major event in the previous month (an M_w 8.7 on March 28, 2005). The majority of the earthquakes were small ($M < 5$) and shallow ($z < 33$ km).

Introduction

The study area, bounded by latitudes 25°N and 12°S, and longitudes 90°E and 135°E, encompasses most of South East Asia. The data used is from the United States Geological Survey's (USGS) National Earthquake Data Centre (NEIC) Website (www.neic.usgs.gov) and from the Malaysian Meteorological Services (MMS) website (www.kjc.gov.my) for the period of January to June 2005.

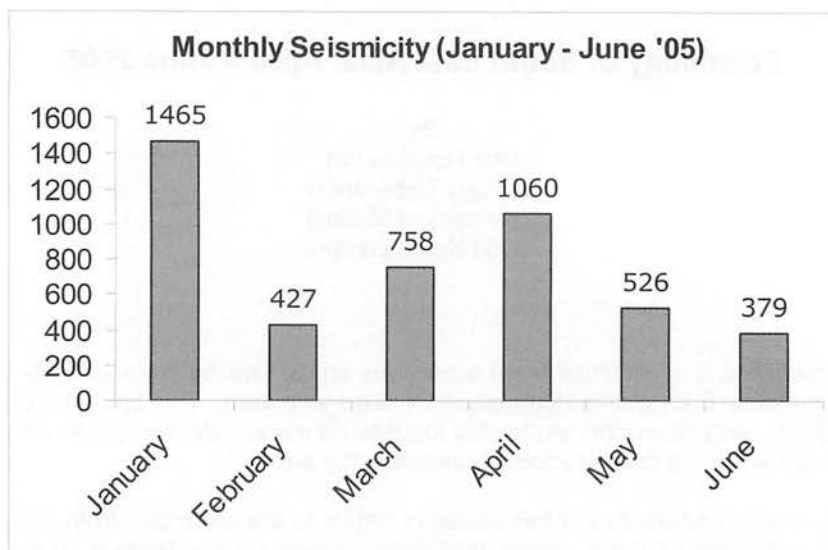
General Seismicity

In total, there were 1906 earthquakes recorded in the study area in the second quarter of 2005 (Table 1). Aftershocks located close to the site of the Great Northern Sumatra Quake (26/12/04, M_w 9.0) are still a major contributor to the seismicity. A decreasing trend is shown by the monthly seismicity: 1060 quakes were recorded in April 2005, followed by 526 in May and 379 in June (Figure 1).

Table 1. Magnitude Distribution (April – June, 2005)

Magnitude	Classification	Frequency	%
< 4.9	Minor to Light	1741	91.34
5 - 5.9	Moderate	149	7.82
6 - 6.9	Strong	16	0.84
7 - 7.9	Major	0	0.00
8 and higher	Great	0	0.00
	Total	1906	

Figure 1. Monthly Seismicity



Compared to the previous months, there was an increase in activity in April. This is due to the occurrence of another great earthquake, an M_w 8.7 that occurred at the end of March, 2005, which had its own aftershocks. In general, the tectonic features that contribute to the seismicity of this area are subduction zones, faults and spreading rift zones that are found in the eastern, western and southern parts of the region (Che Noorliza Lat, 2005).

Magnitude Distribution

More than 90% of the earthquakes in this region had magnitudes of less than 5 (Table 1). There were sixteen strong events ($M > 6$), out of which, twelve was located to the west of Sumatra, probably aftershocks of the December 26th M_w 9 earthquake. These and the one located south of Sumatra were triggered by the subduction of the Indian Plate under the Sunda Plate. The other three, located off the tip of Celebes, in the Molucca Sea, are probably associated with the Talaud-Mayu Ridge collision zone (Hutchinson, 1996). This collision zone has been known to generate earthquakes in the Molucca Sea.

Depth Distribution

More than 80% of earthquakes in this area were reported as having shallow focal (Table 2). This number is biased because earthquakes with unresolved depths are also reported as shallow events. The shallow tremors are consistent with seismicity near a subducting plate boundary and transform faults.

Table 2. Depth Distribution (April – June, 2005)

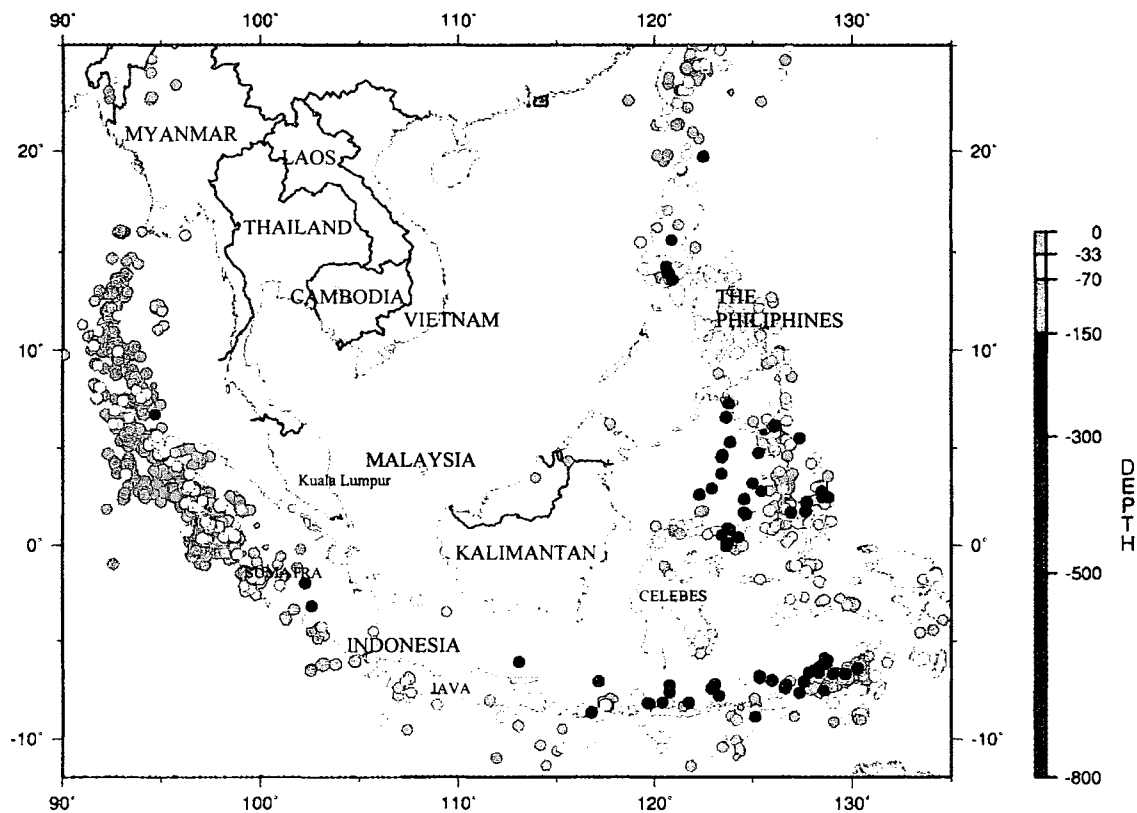
Depth	Classification	Frequency	%
< 33 km	Shallow	1593	81.07
34 - 150 km	Intermediate	300	15.27
> 150 km	Deep	72	3.66
	Total	1965	

The two deepest events recorded in this region had focal depths exceeding 600 km. The first, a magnitude, (m_b) 4.00 was located near Mindanao, Philippines, occurring in a steeply dipping seismic zone west of the Philippines Trench where the Philippines Basin lithosphere subducts under the Philippines Islands. The other deep event, a magnitude (m_b) 4.7, occurred north of Sumbawa Island in Indonesia. This event is associated with Sunda Arc which extends from Sumba, along Java and Sumatra, north to Burma. This is the same tectonic feature that was responsible for the Great December 26, 2004 earthquake. Here, the India-Australia Plate converges at a rate of 7.0 – 7.5 cm per annum (Hutchinson, 1996).

Earthquakes in Malaysia

During April till June 2005, three earthquakes that were located on Borneo Island – a m_b 4.2 north of Bintulu, Sarawak, a m_b 4.9 near the Sarawak-Brunei Border and a m_b 4.5 in Terusan (north of Sandakan), Sabah (Figure 2). All three had shallow foci, ranging from 10 to 24 km. According to the NEIC database for the past 20 years, no earthquakes were ever recorded in Terusan or at the Sarawak-Brunei border. There was, however, one earthquake recorded in Bintulu in 2004 (M_w 5.2, depth 10km on 1/05/04) at coordinates 3.59°N and 113.93°E. The earthquakes near Bintulu and near the Sarawak-Brunei Border are situated near some inactive Pre-Quaternary faults. There is also some active strike-slip faulting nearby. The occurrence of the earthquake could mean that one of the inactive faults has become active or it could be due to the inaccuracy in locating the event. The earthquake in Terusan is associated with a north-easterly trending thrust fault.

Figure 2. Seismicity of South East Asia: April – June 2005



For these local events, there is a discrepancy between the NEIC and the MMS data sets. Table 3 shows the data from NEIC and MMS for these East Malaysia earthquakes. There are no differences in time of the quake, which may be largely due to the fact that the MMS data were reported only to the nearest minute. The MMS reports earthquakes using the local time which is

eight hours ahead of Greenwich Mean Time (GMT). Focal depths were not reported by the MMS but one would suspect shallow origins for this earthquake given the tectonic features of the area. The discrepancy is less than 0.62° in latitude and 0.5° in longitude readings. There is a bigger, up to 12%, difference in the magnitudes reported by MMS and NEIC. This is due to the fact that magnitudes are harder to determine with high accuracy for smaller, local events compared to the respective epicentre and time data. The magnitude not only depends on the availability and quality of the data but also the software used in its determination.

Table 3. Comparison between the National Earthquake Information Center (NEIC) and the Malaysia Meteorological Services (MMS) web data

Date	Time (GMT)		Latitude		Longitude		Magnitude (m_b)		Depth (km)	
	NEIC	MMS	NEIC	MMS	NEIC	MMS	NEIC	MMS	NEIC	MMS
19/04/05	1617 17.33	1617	3.48	4.62	113.90	113.4	4.20	4.8	10	-
23/05/05	1958 9.66	1958	6.26	6.06	117.71	117.7	4.90	6.2	19	-
30/06/05	1809 48.47	1809	4.33	4.07	115.62	115.4	4.50	4.5	24	-

Conclusion

The seismicity of South East Asia (SEA) during the months of April till June 2005 is situated near the Sunda Arc as well as along the segment of the Pacific Ring of Fire that runs through the eastern part of SEA. Aftershocks of the great Sumatra quake of December 26, 2004 still contributed to the majority of the tremors. Most quakes had magnitudes of less than 5 with foci depths of less than 33 km.

Note on the NEIC Database

It is to be noted that there are limitations to this database due to the nature of the seismic network used in the location program making it difficult for the program to precisely determine certain parameters such as the focal depth and magnitude with high accuracy (Che Noorliza Lat, 2005). There are also some earthquakes in the database that do not have either depth or magnitude information. The minimum magnitude recorded is 3.5.

The reported magnitudes are mostly body-wave magnitudes (m_b), as surface-wave magnitudes (m_s) and moment magnitude (M_w) are usually only calculated for the larger (magnitude > 5.5) earthquakes.

Acknowledgement

The author wishes to acknowledge the USGS, NEIC and the Seismology Division of the MMS for making their data available for this study.

Reference:

- Che Noorliza Lat, 2005. Seismicity of South East Asia: January – March 2005. *Warta Geologi*.
- Hutchinson, Charles S., 1996. Geological Evolution of South East Asia, Geological Society of Malaysia, Kuala Lumpur, 368p.

Malaysian Meteorological Services' Seismological Division website, <http://www.kjc.gov.my/english/service/seismology/>, 2005.

National Earthquake Information Center (NEIC) website, <http://www.neic.usgs.gov>, 2005.

Seismo-Tectonic Map of Malaysia, Department of Geological Survey, Malaysia, 1994.

PERTEMUAN PERSATUAN (Meetings of the Society)

Friday Afternoon Technical Talks

19th August 2005

Venue: Department of Geology, University of Malaya,
Kuala Lumpur

The event was organised by The Young Geologists Working Group in collaboration with Malaysia Site Investigation Association (MSIA). The purpose of the event was to share some of the speaker's experience and knowledge with others.

Assoc. Prof. Dr. Tajul Anuar Jamaludin started his talk with an explanation on the occurrence of relict structures that controlled the engineering behaviour of highly weathered to completely weathered rock mass. He highlighted some case studies to show how relict structures affected the stability of slopes.

The second talk was by Mr. Rusli Abdullah of CT Toh Consultant. He highlighted the case where a geologist can be a bored piles designer. He showed the method used and the factors considered to design and construct them and also showed the equipments and tools used.

The last speaker was Mr. Rasid Jaafar, who started with a note that it would be his last talk before leaving for Hong Kong to do his M.Sc. in Engineering Geology. He highlighted his experience on curtain grouting at the Selangor Dam project. He explained in detail the method used taking into consideration the geological aspect as well as the material and machinery used.

There was a good turnout of about 40 participants for the session which ended at about 7.30pm.

Programme:

- 5.00pm : Relict Discontinuities and Cut Slope Instabilities in Humid Tropical Terrain – Malaysian Case Studies
By Assoc. Prof. Dr. Tajul Anuar Jamaludin, University of Malaya
- 5.45pm : Bored Piles in Limestone Areas
By Mr. Rusli Abdullah, Senior Geologist, CT Toh Consultant
- 6.30pm Aspects of Curtain Grouting at Sungai Selangor Dam
By Abd Rasid Jaapar, Soils & Foundations Sdn Bhd

BERITA-BERITA PERSATUAN (News of the Society)**Word From The President****RESIGNATION OF GSM EDITOR**

We are sad to inform you that our Society's editor, Dr. Liew Kit Kong, has resigned from his post in an e-mail dated 6 June 2005. The President and two Council Members, Dr. Iskandar Hj. Taib and Mr. Lau Yin Leong met up with Dr. Liew to discuss some of the issues raised and tried to persuade him to serve till the end of his term but he declined.

The Council met on 28 June 2005 to discuss the immediate measures that need to be implemented to ensure that the Society's publications can continue to be produced until a new editor is found or elected at the next AGM. Although we are empowered by the Constitution to appoint a new Editor, we have not found a candidate for the post. We have however, received an offer to help edit the Society's Newsletter from Dr. Ahmad Tajuddin Hj. Ibrahim and to edit the Bulletin and other publications from Dr. Iskandar Hj. Taib till the present term is completed or until a new Editor is found.

We hope that you would give your full support and cooperation to our two Chairmen of the editorial subcommittees for producing the Warta and Bulletin so that the Society's publications would not suffer. Thank you.

Lee Chai Peng
President
Geological Society of Malaysia
29 June 2005

Word From The Chairman of the Editorial Committee

1. I would like to thank the Council for their confidence to let me handle the Warta Geologi temporarily until a new editor is formally elected. I hope members would continue to send in articles suitable for Warta and at the same time I will try to get the issues out on time. I would like to include news concerning members in the coming issues. So please send in any good or sad news that you think should be made known to the others.
2. I would like to apologise for the mistakes in the list of Council Members as listed on the inside front page of the last issue. The correct list is as listed in this issue. My apology also for the delay in putting in the announcement from the President above which should also have been in the last issue.

Keahlian (Membership)

Full Members

Nizarulkiram Abdul Rahim
 Jabatan Mineral & Geosains,
 Tkt 19-22, Bangunan Tabung Haji,
 Jalan Tun Abdul Razak,
 50658 Kuala Lumpur.

Pertukaran Alamat (Change of Address)

The following members have informed the Society of their new addresses:

Dr. Liaw Kim Kiat,
 EPG-X-XNTL, SNEPCo,
 21/22 Marina, P.M.B. 2418,
 Lagos, Nigeria.

Dr Kamaludin bin Hassan,
 Jabatan Mineral & Geosains Sarawak,
 Jalan Wan Abdul Rahman,
 Kenyalang Park,
 Peti Surat 560,
 93712 Kuching.

Odegaard Sdn Bhd,
 Level 9, West Block,
 Wisma Selangor Dredging,
 142C, Jalan Ampang,
 50450 Kuala Lumpur.

Cheong Tze Ling,
 19, Taman Tualang,
 31800 Tanjong Tualang,
 Perak

Alamat Baru Dikehendaki (Current Address Wanted)

1. Dan Spancers, USA.
2. Takeshi Sagae, Tokyo, Japan

Pertambahan Baru Perpustakaan (New Library Additions)

1. AAPG Explorer, July 2005,
2. Geosciences Journal, Vol. 9, No. 2, 2005,
3. Acta Geoscientica Sinica, Vol. 25, Nos. 5 & 6, 2004 & Vol. 26, Nos. 1 & 2, 2005
4. Earth Science Frontiers, Vol. 11, Nos. 3 & 4, 2004 & Vol. 12: Supplement, Nos. 1 & 2, 2005.
5. Goescience, Vol. 18, No. 4, (2004) & Vol. 19, No. 1, (2005),
6. Journal of Shijiazhuang University of Economics, Vol. 27, Nos. 5 & 6 (2004) & Vol. 28, No. 1 (2005),

7. The Krakataus: Changes in a century series catastrophic eruption in 1883. Compiled by Hideo Tagawa, 2005.
8. Episodes, Vol. 28, No. 1, 2005
9. Nature & Human Activities, No. 9 (2005)
10. Humans & Nature, No. 15 (2005),
11. Geosciences Journal, Vol. 9, No. 1 (2005),
12. Malaysian Science & Technology Congress 2005
13. U.S.G.S. Professional Paper: Nos. 1695, 1685 (2004)

BERITA LAIN (Other News)

Up Coming Events In Malaysia

2006, June 14
 Geo Asia 2006 Conference
 Kuala Lumpur Convention Centre, Kuala Lumpur.
 Email: nar@mesallworld.com; Web Site: www.geo-asia.com

Up Coming Events Outside Malaysia

2006, May 22-24
 3rd IAG Symposium on Geodesy for Geotechnical & Structural Engineering and 12th FIG Symposium on Deformation Measurements
 Baden, Austria
 Email: conf@pop.tuwien.ac.at; Web Site: <http://info.tuwien.ac.at/ingeo/sc4/baden/>

2006, June 12-15
 European Assoc. of Geoscientists & Engineers (EAGE)(68th International Conference & Exhibition)
 Vienna, Austria.
 Web Site: <http://www.eage.org/conference/index2.phtml?cpnfid=40>

2006 June 17-21
 International Palaeontological Congress (2nd)
 Beijing, China
 Email: IPC2006@nigpas.ac.cn; Web Site: <http://www.ipc2006.ac.cn/>

2006, September 6-10
 ENGINEERING GEOLOGY OF TOMORROW'S CITIES
 Nottingham, UK
 Website: www.iaeg2006.com

2006 November 8-10,
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 Singapore
 Email: info@arms2006.org; Web Site: www.arms2006.org



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- Bulletins 19** (Apr 1986) & **20** (Aug 1986). GEOSEA V Proceedings Vols. I & II, Fifth Regional Congress on Geology, Mineral and Energy Resources of SE Asia, Kuala Lumpur, 9-13 April 1984. Edited by G.H. Teh & S. Paramanathan. Price for both Bulletins 19 & 20: Members: RM30.00; Non-Members: RM60.00.
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