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Geology of Yogyakarta earthquakes 2006 (central Java, Indonesia): Current understanding based on integration of research outputs in geology, geophysics and remote sensing.

A. **Lucas Donny Setijadji** (1,2), B. Koichiro Fukuoka(1), C. Sachio Ehara(1) and D. Koichiro Watanabe (1)

(1) Graduate School of Engineering, Kyushu University, Fukuoka 819-0395, Japan, (2) Department of Geological Engineering, Faculty of Engineering, Gadjah Mada University, Yogyakarta 55281, Indonesia (lucas@mine.kyushu-u.ac.jp)

The 27 May 2006 earthquake that hit the Yogyakarta region (central Java, Indonesia) was determined to be shallow (10 km bsl) with a moment magnitude of 6.4. Due to its huge damages on human casualties and materials, the active fault system must be well characterized to prevent future seismic hazards. Unfortunately, no previous study on active faults was done in this region as central Java was considered as seismically inactive. Many geoscientists argue (without any solid evidence) that earthquakes were located along the now-burdened Opak fault, and that this fault was reactivated. In order to better clarify the state of active fault, an international research group consisting of Indonesian and Japanese geoscientists have been conducting collaborative geologic, geophysics, and remote sensing investigations on the damage areas.

Interpretation on the subsurface structure using gravity data suggests that the geologic setting of active fault system is located at the eastern margin of a volcanic-tectonic depression called as the Yogyakarta basin. The basin is NE-SW oriented depression measuring 16-22 km wide and at least 45 km long. During the Cenozoic era the basin was site of extrusions of multiple volcanic centers; some are currently burdened by Quaternary volcanics. Radiometric and geochemistry data suggest that volcanism events occurred since the Oligocene to Recent. Due to these intrusions of volcanic centers, the sub-surface feature of Yogyakarta basin is currently divided into smaller zones of sub-basin “highs” (e.g. Godean and Piyungan) and “lows” (e.g. Bantul and Pram-

banan). Sub-basin highs and lows are supposed to be separated by faults of several generations. Opak fault is interpreted to be the youngest fault system, and is a SW-NE trending normal fault at the eastern part of Yogyakarta basin. This fault was active since the Plio-Pleistocene and whose vertical displacement is at least 200m.

Results of our microseismic survey on aftershocks in the period of June-August 2006 observation suggest that the currently seismically active region is not located along the Opak fault. Rather, our observation suggests that the ruptured fault during the 27 May 2006 earthquake is located about 10km east of Opak fault, within the domain of Tertiary volcanic edifices. Our current conclusion is that the earthquake 27 May 2006 was caused by reactivation of an older Tertiary fault. As the location of suspected active fault is remote from the most severely damage areas, we consider that other geotechnical aspects have took dominant control on determining the scales of damage. These include the thickness and types of Quaternary deposits that cover the low-land areas, and engineering aspects of public and private constructions.