The June 8, 2008, M_w6.3, NW Peloponnese Earthquake

Apostolos S. Papageorgiou
Department of Civil Engineering
University of Patras, Greece
(papaga@upatras.gr)

A moderate size earthquake with Moment Magnitude M_w 6.3 (USGS) occurred on Sunday, June 08, 2008 at 12:25:30 UTC (03:25:30 PM at epicenter), at the NW corner of Peloponnese, central Greece, about 35 km southwest of the city of Patras, in the vicinity of the towns of Andravidha and Amalias (location of epicenter: 38.000°N, 21.468°E; USGS). The epicentral intensity (MMI) was estimated to be VIII (accelerographs at a distance of ~30 km from the epicenter recorded PGA 0.24g; NOA), while the city of Patras (population 164,000) and the nearby town of Rio (where the Rion-Antirion Bridge, named 2005 Outstanding Civil Engineering Achievement Award Winner by ASCE, is located; Combault et al. 2005) were shaken quite strongly (MMI intensity VII; PGA 0.12g). The quake was felt in many parts of Greece, and as far to the north and west as Tirana, Albania, and Cosenza, Italy, respectively. There were two fatalities and several people were injured (USGS; NOA). About 10,000 structures sustained some kind of damage. Severe damage afflicted primarily, although not exclusively, old masonry structures. In Kato Achaia, to the northeast of the epicenter, railroad tracks were distorted. Liquefaction was observed at various locations in the general epicentral area.

A number of significant earthquake events have occurred in the neighborhood of the present event in the last twenty years (NOA): Vartholomio Oct 16, 1988 M=6.0, Pyrgos March 26, 1993 M=5.5 and M=5.8, Vartholomio December 2, 2002 M=5.8, Patras July 14, 1993 M=5.6.

The crust of mainland Greece and the Aegean Sea is located between three major tectonic plates: The Eurasian, African and Arabian plates. The crust of Asia Minor (Turkey), under the pressure of the Eurasian and Arabian plates is “squeezed out” to the west, and thus, in turn, applies pressure to the various micro-plates that constitute the crust of the Aegean Sea and mainland Greece. The induced tectonic stresses are accommodated by deformation zones that are primarily east-trending and northeast-trending. The east-trending deformation zones are associated with normal faulting mechanisms, while the northeast-trending deformation zones are associated with strike-slip faulting mechanisms (Goldsworthy et al. 2002; Nyst and Thatcher, 2004; USGS). The distribution of aftershocks of the June 8, 2008, earthquake delineate a northeast trending fault plane, consistent with the fault mechanism inferred by USGS and NOA (see EMSC, 2008) which indicates a nearly vertical right-lateral strike-slip fault plane. The strike of the fault plane is, for all practical purposes, parallel to the Cephalonia Fault Zone which is located to the northeast of the causative fault that generated the June 8, 2008 event.

Various surface expressions of the faulting have been observed and are under investigation (Kokkalas, et al. 2008). In particular, northeast-trending ruptures have been observed in a 500 m wide zone of diffuse deformation, located roughly in the area where the aftershock cluster intersects the coast. This rupture zone has a length of ~4km and aligns with the direction established by the aftershock distribution.

A significant number of strong motion instruments in the region of the causative fault were triggered. Strong motion instruments as far as Corinth and Athens to the east and Kalamata to the south, were triggered (NOA). Several (16) of these instruments were operated by NOA, while a few others (5) were operated by ITSAK. A significant number of accelerograms has been recorded also at the Rio-Antirion bridge (personal communication with the staff of 'GEFYRA' that operates the Rion-Antirion bridge). Based on these recordings, the intensity of ground shaking at the southern (Rio) approach of the bridge was stronger (PGA 0.12g) than the intensity at the northern (Antirion) approach.

The strong motion data recorded with instruments operated by ITSAK were made immediately and readily available to the public. Horizontal components of three of the ITSAK stations (PYR1, VAR2 and PAT3, recorded at Pyrgos, Vartholomio and Patras, respectively) are shown on the Figure. These recordings suggest that the rupture propagated primarily to the northeast, although some propagation to the southwest cannot be excluded in view of the strong accelerations (0.24g) recorded at Amaliada with instruments operated by NOA. The main event was composed of at least two main sub-events, the signatures of which are evident on the recordings of stations PYR1 and VAR2. The radiations of these sub-events are fused in the recordings of PAT3. Furthermore, the frequency content of the motion recorded at PAT3 indicates that the sediments underlying the PAT3 station strongly affected the incoming waves. Basin generated surface waves are fairly evident even on the acceleration record. The spectra of the motions recorded at PAT3 indicate a strong amplification of the incoming seismic energy over the period band 0.80 – 1.50 sec. It is necessary however to caution that further careful investigations are necessary to confirm the above preliminary observations.

REFERENCES

EMSC: European-Mediterranean Seismological Centre, http://www.emsc-csem.org/index.php?page=current&sub=recent&evt=20080608_GREECE, (accessed June 20, 2008).

GEFYRA: Rion_Antirion Bridge, http://www.gefyra.gr, (accessed June 20, 2008).

ITSAK: Institute of Engineering Seismology and Earthquake Resistant Structures, http://www.itsak.gr/documents/AchaiaIlia/index.html, (accessed June 20, 2008).

NOA: National Observatory of Athens, Institute of Geodynamics, http://www.gein.noa.gr/services/skyros.html, (accessed June 20, 2008).

USGS: US Geological Survey: Earthquake Hazards Program, http://earthquake.usgs.gov/eqcenter/eqinthenews/2008/us2008taaw/#details, (accessed June 20, 2008).

Combault, J., A. Pecker, J.P. Teyssandier and J.-M. Tourtois (2005). Structural Engineering International, Rion-Antirion Bridge, Greece – Concept, Design, and Construction, 1, pp. 22-27.

Goldsworthy, M., J. Jackson and J. Haines (2002). The continuity of active fault systems in Greece, *Geophys. J. Int.*, 148, 596–618

Kokkalas S., P. Xypolias, I. Koukouvelas (2008). Surface ruptures of the recent M_w 6.3 (June 08, 2008) earthquake event in the northwestern Peloponnese: a preliminary field report.

Nyst, M. and W. Thatcher (2004). New constraints on the active tectonic deformation of the Aegean, *JOURNAL OF GEOPHYSICAL RESEARCH*, VOL. 109, B11406.

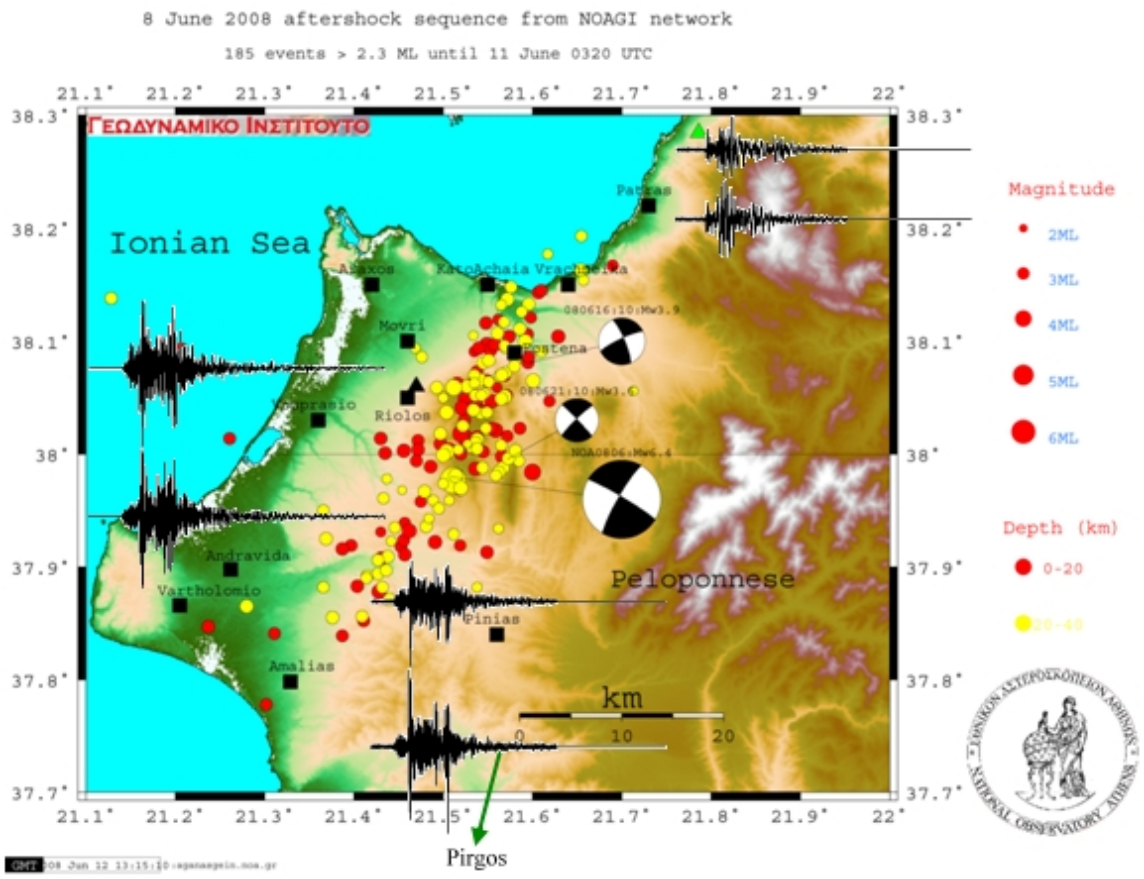

FIGURE CAPTION

Distribution of aftershocks following the main event (June 08, 2008 at 12:25:30 UTC) up until June 11, 2008, at 03:20 UTC (modified from an original figure prepared by Dr Ath. Ganas, National Observatory of Athens, and posted on EMSC). Also shown are the two orthogonal horizontal components of acceleration recorded at the stations PYR1, VAR2 and PAT3.