Quick report on the surface effects of the June 8, 2008, NW Peloponnese earthquake

by the Aristotle University of Thessaloniki – Department of Geology team:

Chatzipetros A., Valkaniotis S., Papathanassiou G., Sboras S., Neofotistos P., Mavrodis P. and Pavlides S.

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contact: ac@geo.auth.gr, pavlides@geo.auth.gr

This report summarizes the observations of surface effects during the June 08, 2008 earthquake of NW Peloponnesus (temporarily known as "Ilia – Achaia earthquake"). The event of magnitude 6.5 (A.U.Th.) or 6.4 (N.O.A.) was caused by a NNE-SSW striking dextral fault, as suggested by the focal mechanisms issued by A.U.Th., N.O.A., U.S.G.S., Harvard and others.

Surface effects

The following paragraphs describe in brief the observed effects of the earthquake in various sites of the epicentral area. The classification follows the nature of the effects themselves, rather than a geographical distribution. It is therefore arranged in the following categories:

1. Surface ruptures.
2. Liquefaction phenomena.
3. Slope movements (rockfalls, landslides, etc.)

Surface ruptures

Surface ruptures were spread over a large area. There were however certain cases where long lines of ruptures were observed:

Psari – Nisi line

This is a long (>5 km) line of NNW-SSE striking open ruptures with local normal character and slight strike-slip component (Figure 1). They are aligned in a left-stepping *en échelon* arrangement and generally follow the adjacent river scarp. A shear zone with no significant vertical displacement coincides with the general strike of the surface ruptures (Figure 2). It is also associated with liquefaction and slope movements along its strike (Figure 3).

Figure 1. Detail of part of the NNW-SSE trending fracture line near Psari village. The vertical displacement is evident.

Figure 2. A high-angle shear zone aligned with the Psari-Nisi surface rupture. Small seismic ruptures of the same NNW-SSE strike, as well as aligned slope movements, were observed in this area.

Figure 3. Ejection of liquefied material associated with the Psari – Nisi rupture line.

Mihoi line

Mihoi is the village that rests closest to the epicenter. A rather long (>2 km) rupture line of WNW – SSE strike was observed at the hills west of Mihoi (Figure 4). It forms a deformation zone of up to 6 m wide, while it is also associated with rock falls and landslides (Figure 5).

Figure 4. Part of the seismic Mihoi fracture line.

Figure 5. A small rock fall associated with ruptures of the Mihoi line at the fore-ground.

Liquefaction phenomena

There was widespread liquefaction in large areas that are more or less aligned mainly to the main NNE – SSW fault zone, but also to secondary faults that were mapped.

Lake Pineias

Extensive liquefaction caused ejection of material along cracks in several sites around Lake Pineias. Four main types of liquefaction phenomena were recognized in the field:

1. Ejection of material along ruptures (Figure 6).

2. Sand and mud volcanoes (Figure 7).
3. Sand and mud flows.
4. Lateral spreading (Figure 8).

Figure 6. Detail of a surface rupture through which fine material was ejected.

Figure 7. A series of mud volcanoes.

Figure 8. Part of a long (>500 m) rupture associated with lateral spreading.

Kato Achaia

Kato Achaia is located way north of the epicenter, but local conditions (sandy soil and high aquifer level) caused very high acceleration values, resulting in impressive liquefaction phenomena, including surface ruptures (Figure 9), rupture ejections (Figure 10) and mud volcanoes.

Figure 9. Surface rupture parallel to the coastline associated with liquefaction at Kato Achaia.

Figure 10. Ejection of liquefied material along surface ruptures of NNW – SSE strike.

Slope movements

Earthquake associated slope movements (rock falls, landslides, etc.) were spread over a very wide area. The epicentral area was mainly affected by rockfalls along the steep slopes of the very impressive Skollis Mountain (Figure 11), which caused damages at roads and houses around Santoneri village (Figure 12). The road network was affected in many areas, either by failures (Figure 13) or rock falls.

Other slope movements in many other sites were associated with either morphological or secondary tectonic causes (Figure 14 and Figure 15). Environmental effects of the earthquake were observed as far as Livadia (Arkadia) to the east or Porto Katsiki beach (Lefkada island) to the west (Figure 16).

Figure 11. View of Skollis Mountain. Both its western and eastern slopes were totally affected by rockfalls and landslide. According to eyewitness accounts, the slopes were covered "in a white dust" for more than 15 mins due to widespread slope movements.

Figure 12. A large rock blocked this road in Santoneri after destroying a house at its course.

Figure 13. Road failure due to slope movement between Santoneri and Portes.

Figure 14. Slope movements like this one were observed in many sites at the epicentral area.

Figure 15. This slope failure exposed and damaged the irrigation pipe.

Figure 16. Rock fall at Porto Katsiki beach (Lefkada island) during the earthquake. Photo published in Greek electronic media.

Remarks

The distributions of aftershocks indicate a linear dextral seismogenic structure of NNE – SSW strike. It is however noteworthy that no significant surface ruptures of this orientation were observed in the field. The only closely spaced set of ruptures that are in agreement with this direction is the one associated with linear ejections of liquefied material at Lake Pineias shores. Two more directions of surface ruptures, one NNW – SSE and one WNW – ESE were also observed, but the aftershock sequence indicates that they are probably secondary reactivations of existing weakness zones.

Other surface effects, such as slope movements and liquefaction are widespread and generally not aligned in specific orientations.

While elaboration of the data is in progress, the linkage between surface effects and the main dextral deformation zone remains an issue to be investigated.