Changes of the groundwater levels and crustal strains for the Yamasaki fault earthquake (M3.8) on April 17, 1999

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The Yamasaki Fault earthquake (M3.8) occurred on April 17, 1999, and 2 observation points(GSJ) near the epicenter observed changes of crustal strain and water level. Particularly, changes of crustal strain were notable.

Observed coseismic steps of strain are much larger than the strain changes caluculated from source fault which is estimated from the nodal plain solution and the seismic moment and from the assumption that the crust is half-infinite homogeneous elastic body. Consequently, coseismic changes at yst caused by source fault slip cannot explain observed coseismic steps of strain.

Observed preseismic changes of strain are the same order of coseismic step, so similarly, this changes also cannot be explained by the preseismic slip near the source fault.

Geological Survey of Japan(GSJ) made an groundwater observation network composed of wells mainly along active faults in and around the Kinki district, for earthquake prediction research, and started continuous observation of the groundwater level and others in 1998.

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"yst", Yasutomi observation point (34.98N,134.61E) is near the Yasutomi Fault which is one of main faults of the Yamasaki Fault system. There are 3 wells at intervals of about 10 m each other. The depth of screen(perforated well casing) of well No.1(yst1) is 254-265 m, and those of well No.2(yst2) and No.3(yst3) are 144-149.5 m. yst1 has 3-component borehole-type strain meter, and the depth of that is 290 m. yst2 and yst3 has been sealed off since May 25, 1999, because water levels were above the ground level. And water pressures are converted into water levels. yst1 has been sealed off inadequately, so data were bad at April 12, 1999.

"ysk", Yasutomi-kita observation point (34.98N,134.61E) is about 4km north of yst. And the depth of screen is 131.7-137.1 m. ysk also has been sealed off.

These data are measured every 2 minutes and recorded in local recorder. After that, they are transmitted to GSJ by communication lines once or twice a day.

The earthquake (M3.8) occurred at the east end of the Yasutomi Fault at 17:31 on April 17, 1999. The depth of that was 18 km, and the epicentral distance to the nearest observation well, yst, was 10 km. The nodal plane solution for the earthquake decided by DPRI, Kyoto University,was strike-slip type and the P-axis direction is N68E. The strike of one side of two nodal planes was similar to that of Yasutomi Fault (about N100E), so this earthquake was closely related to the Yasutomi Fault.

When the earthquake occurred, the notable coseismic steps of 2 components were observed in 3 components strain meter at yst. 45 nanostrain contraction was observed at N312E component. At N192E component, plain changes was not appeared. At N72E component, 101 nanostrain extension was observed, but this had some error because output of the strain meter was automatically shifted simultaneously with the earthquake occurrence at N72E component.

About preseismic changes, at N72E component, about 10 nanostrain contraction and at N312E component, about 20 nanostrain extension were observed.

About coseismic changes of water level, at yst2, about 10 mm rise and at ysk, about 3-5 mm drop were observed.

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Factors of this changes are,

1.Disturbance of local strain field by casing bore-hole,

2.Coupling between strain meter and the base,

3.Effect that observation point is in the fracture zone.

In addition to these factors,

4.Aseismic slip near the observation point
should be considered. We present the consideration of the above 4 factors.