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Construction of diagnostic research of fault zone by fault- fluid monitoring

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It has been well known that change in water level in the wells and in chemical compositions of ground water is frequently associated with large earthquakes. Research for change in physical-chemical properties of fluid associated with earthquakes is still continuing all over the world including Japan.The main target of this kind of research was to detect anomalous signals, which can be interpreted as precursor of the earthquake. Some records of fluid data suggested clear signature of precursor of a large earthquake, which were interested in by many researchers. However, at present, fluid-monitoring research to explore earthquake precursor is significantly declined. The goal of the way of research would inevitably be ”statistics”. However, the researchers had not been interested in examinations whether observed change can be explained strictly by physical and chemical process in the crust associated with earthquakes. Consequently, fluid monitoring to find seismic precursor becomes an ironic example to lose support from seismic society.

Recently the presence of fluid that can be defined as fault fluid has emerged by development of fault zone material science. Fault fluid is defined as follows and if the presence and the premise of this fluid are acknowledged, the observed results are interpreted as follows. Active fault zone has fracture zone at one side or both sides of fault surface, which shows higher permeability than surrounding host rocks, indicating that the crustal fluids preferentially flow through the fracture zone in the crust. Therefore, change in fault-fluid properties associated with earthquakes exclusively means that (1) change in fluid path connection-disconnection and (2) fluid - fractured rock interaction resulting in change in fluid properties.

If we acknowledge above consideration, fluid-monitoring related to seismic activities is changed form statistic research to diagnostic research. Long time effort of try and error is necessary to realize above consideration and establish the measurement method. At present, following three subjects are especially important. First, establish the reliable basis to choose the location of well to monitor the fault zone fluid , second, designing and constructing the mass-spectrometer which have sufficient performance for fluid continuous monitoring at on-site close to the fault zone, and finally, establish and improvement of diagnostic theory of fault zone fluid.

Some results from above point of view will be reported and discussed in this session. Sugai et al., (2013) performed chemical mapping of hot springs and compared them with geological and topographical maps, which gives us insight to find the better location for fault-fluid monitoring. Tsunomori et al. (2013) will report long time variation of radon concentration, which is necessary to evaluate the episodic change of radon concentration by seismic activity. Terusawa et al (2013a) will report the results of measurements of permeability of gas membrane, which will be installed to the mass spectrometer. They also report the fundamental process resulting in change in gas concentration.

The purpose of this presentation is to summarize and supplement above researches and introduce high resolution mass-spectrometer (GROWDAS).Kawabata et al./(2013) will report the site-construction and data presentation techiniques about our Website.

Keywords: fault, fracuture zone, fluid, monitoring, hot spring, mass-spectrometer