Change of the seismic activity in the cycle of a large earthquake

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It is well known that major earthquakes along a certain plate boundary occur periodically. Large earthquakes along a specific active fault also occur periodically. Relating to this periodicity of major earthquakes along a fault, microearthquakes frequently show periodic activity.

After the occurrence of a large earthquake, very high activity continues for several or dozens of years (Watanabe, 1989). After that, the activity decreases and shifts to a calm term. Then, after a long calm interval, the following large earthquake will occur (Toda, 2002). Before this large earthquake, the increase of seismicity is frequently recognized. Generally speaking, the seismic activity cycle along an active fault can be classified into 4 stages, namely, the main shock stage, aftershock stage, calm stage and pre-seismic stage (Mogi, 1985).

Although the time interval of earthquake cycle of an inland active fault is generally as long as hundreds to thousands of years, the interval of the modern seismology is only dozens of years. Therefore, we can see only a part of one cycle.

Considering that many active faults exist in the Japanese Islands and that large earthquakes do not occur only in a specific historical epoch, it can be thought that the activity stage of each fault varies with each other. By connecting seismic activities of various stages on the basis of the lapse time from the last large earthquake, the synthesized seismic cycle of an active fault may be reproduced.

The technique for evaluating seismic activity of many active faults in a wide area had not been established before. However, we proposed a new method for quantitative evaluation of inland seismic activity by using GIS (Itaba et al., 2003). By using this method, the evaluation of different active faults apart from each other can be attained. In this study, reappearance of the seismic cycle on the basis of the lapse times from the last large earthquake (M=6.5 or over) was tried. Consequently, for active faults with long lapsed time from the last large earthquake, the seismic activity is clearly low. This low activity means that those faults may be in the calm term now. But some active faults with the long lapse time from the last large earthquake show high activity. These can not be considered to be aftershock terms. A possibility of having shifted to the pre-seismic term is also considered.

It is expected to know at what stage of seismic cycle the active fault is. These approach may contribute to earthquake disaster prevention program.