Origin of the active faults in the eastern SW japan and its relationship to the preesent-day convergent tectonics

Ken-ichi Kano[1]

[1] Faculty of Sci., Shizuoka Univ.

I present hear that the active faults in the eastern SW Japan, the Chubu region, are strongly controlled by anisotropic geologic structures of the inhomogeneous basement rocks and were originated before the Quaternary, but not made as conjugate sets under E-W horizontal compression during the Late Quaternary. Then, the relationships between the activity of these faults and the present-day convergent tectonics will be discussed.

The Jurassic Mino-Tanba accretionary complex (MTAC: one of the main constituents of basement rocks of the eastern SW Japan) in the western Tanba area is trending E-W. The trend change to N-S around Lake Biwa and change to NW-SE in the Mino area, forming a gigantic cuspidate bend, called the Neo Syntaxis, with its convex side toward N. The hinge of the Neo Syntaxis is the Tsurugawa-Isewan Line, which is regarded as a major neotectonic boundary of SW Japan. Many N-S trending active faults, including the Hanaore, Tsuruga, Yanagase, Ichishi, and Yoro faults, develop around this hinge. Most of them run along the hinge of km-scale sub-bends (megakinks), suggesting that their origin is intimately related to the formation of megakinks. The NNW-SSE Hachiman fault in the eastern wing of the Neo Syntaxis is also rest on a hinge of megakink. The Neo Syntaxis and the mgakinks within it are believed to be formed in association with the Early-Middle Miocene opening of the Sea of Japan and the collision of the Honshu Arc with the Izu-Bonin Arc (Kano, 2002: Bull. Earthq. Res. Inst., U. Tokyo, 77, 231-248). The Nobi fault system runs just on the hinge zone of km-scale and NW plunging anticlinorium in the MTAC. The NE-SW faults in the Kiso area, such as the Narai and Magome faults, also run parallel to the trend of the MTAC. The Inadani active fault system is also parallel to the trend of the metamorphosed MTAC. These relationships suggest that the origin of these active faults were strongly controlled by the structure of the MTAC.

Some of the NW-SE trending faults, such as the Atera fault, might have been formed in association with the Late Cretaceous volcano-plutonic activity. The NE-SW trending faults in the Hida area, including the Atotsugawa and Ushikubi faults, were originally formed as sinistral strike-slip ones during the Late Cretaceous, and have re-activated dextrally during the Late Quaternary (Oohashi & Kobayashi, 2008: J. Geol. Soc. Jpn., 114, 16-30).

These examples strongly suggest that the strike-slip faults in Chubu, now being active, were not formed as conjugate sets in the Late Quaternary. Some of the faults were probably produced in association with the accretion during the Late Jurassic, and some during the Late Cretaceous. Many of them were produced or re-activated during Early-Middle Miocene. Hence, most of the active faults are considered to be the re-activated pre-existing ones under the present-day stress regime.

Recent seismic study has revealed that the upper surface of the subducting Philippine Sea Plate (PHS) is gently upwarping beneath the lower crust of Chubu region (Hirose et al., 2007: Zishin, II, 60, 1-20). The curvatures of 30-60 km depth contours of the upper surface are nearly parallel to the cuspidate shape of the Neo Syntaxis and its upwarping axis lies just below the hinge zone. This suggests that the subduction of PHS beneath the Neo Syntaxis is probably controlled its overriding crustal structure. If this is the case, the stress regime around there may be mainly controlled by the NWward subduction of the PHS. The NW-SE to WNW-ESE trending P axes of earthquakes and the shortening strains of the same direction estimated by GPS in Chubu also suggest the effect of subduction of the PHS. Now, we must re-evaluate the activities and significances of the active faults in Chubu, not based on the classical conjugate-fault hypothesis under E-W horizontal compression. One possible explanation is that some of the active faults are moving as a transfer fault system.