Strike-slip Faulting and Block Structure Along the Inner Zone of SW Japan

Fabbri Olivier[1], Yuji Kanaori[2], Kazumasa Iwamura[2], Satoshi Matsunaga[3], Guilhem Coromina[4]

[1] University of Franche-Comte, [2] Earth Sciences,Yamaguchi Univ,[3] NISSAKU,CO.,LTD.,[4] University of Franche-Comte

Between the Median Tectonic Line (MTL) and the Japan Sea, the Inner Zone of SW Japan is cut by a series of N45E first-order faults and N135 to N170E second-order faults. This fault network defines an upper crustal block structure (Kanaori, Tectonophysics, 1990) for which paleomagnetic investigations revealed vertical-axis rotations achieved before the Late Miocene. In order to select targets for future neotectonic and seismotectonic investigations and to examine past and present fluid flows in fault zones, we analysed the fault network in the western part of the Inner Zone (Chugoku region).

Regional-scale geometry and evidence for opposite senses of overall shear at different epochs.

The overall geometry of the fault system was mapped by using Landsat images and aerial photographs. The obtained fault pattern displays a striking similarity with fault patterns obtained with experiments of simple shear deformation distributed at the base of a brittle layer analog over its entire width (basal distributed flow; Schreurs, Geology, 1994). This similarity suggests the possibility of a mid-crustal, low-angle detachment which could have controlled the formation of the fault system in Cretaceous to Tertiary times. The detachment could have emerged along the proto-MTL, a 45degree-dipping strike-slip normal fault recently imaged by seismic reflection studies and whose trace approximately coincides with the present-day steep-dipping MTL. Fault surface indicators and displaced geological markers suggest that the first-order faults experienced sinistral slip whereas the second-order faults experienced dextral slip. The overall shear was sinistral. Geomorphic evidence and earthquake focal mechanisms of recent events (e.g., the M 6.1 Yamaguchi-Ken Hokubu earthquake in 1997 or the M 6.6 Western Tottori earthquake in 2000) indicate that the Plio-Quaternary to present-day slip senses are opposites to the pre-Plio-Quaternary ones: slip along first-order faults has changed to dextral while that along second-order faults has changed to sinistral. The overall sense of shear is dextral, in agreement with the present-day direction of relative convergence between the Philippine Sea and Eurasia plates (N45W).

Detailed Structure of Representative Fault Zones

Detailed studies of selected fault zones were focussed on two points: (1) the geometry and kinematics of each elementary fault and the nature of the transfer zones (relays) between adjacent elementary faults, and (2) the nature and distribution of fault rocks.

(1) Because of the Plio-Quaternary inversion of the sense of shear, pre-Quaternary transpressive relays have changes to transtensive, and vice versa. Fault relays are therefore complex and different from classical examples. They constitute important targets for future seismotectonic studies.

(2) Fault rock examination has revealed two main characteristics:

- seismic slip (attested by injected breccias) alternated with creep motion (indicated by foliated gouges);
- fluid flow has been very active within the fault zones, as suggested by pervasive solution seams (stylolites) and tension gashes in granitoid host rocks, and by present-day hydrothermalism.

The proposed model aims at establishing spatial and temporal links between seismic/aseismic slip on one side, and high/low pore-fluid pressures on the other side.