Structural geology field course in Argentina: 1. An enormous shortening after the Miocene caused by the low-angle plate subduction

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Prof. Toru Takeshita and Prof. Cees Passchier at University of Mainz, Germany gave a structural geology field course in Argentina and Chile during the period between September 25th and October 5th, 2006. At the Japan Geoscience Union Meeting, 2007, we will give two presentations on the geological outline of the field course: one is about an enormous east-west shortening in the Andes and its foreland after the Miocene, senior-authored by T. Takeshita, and the other about a shear zone in Paleozoic basement rocks in Argentina, senior-authored by Y. Harigane.

Although the tectonic model of Chile-type subduction boundary, proposed by Ueda and Kanamori (1978), has been well-known, it seems that geological phenomena resulting from the low-angle subduction of the Nazca plate have been little introduced in Japan. It has been inferred that at 27^o-33^o south latitudes the low-angle subduction or flat-slab was commenced by the collision of the aseismic Juan Fernandez ridge with the marginal part of Chile, which propagated from north to south during the time period between 18-11 Ma. During the Early Miocene period (20-16 Ma), the volcanic front was situated at the position 300 km far from the trench, which is comparable with that of the northeast Japan arc. Hence, a normal subduction of oceanic plate occurred during this time period. However, at 33^o south latitude, the volcanic front greatly retreated towards the inland after the collision at 11 Ma. Finally, the arc-volcanism has ended after the one at the location 800 km far from the trench at 1.9 Ma. The volcanic front is believed to form at the position, where the depth of the upper surface of subducting slab is ca. 100 km. Accordingly, such low-angle subduction or flat-slab that the upper surface is located at the depth of 100 km for the distance 800 km far from the trench (7^o of the average subduction angle), occurred at 1.9 Ma. In the Japanese islands, the location 800 km far from the trench is in the middle of the Japan Sea.

As the position of the volcanic front retreated towards the inland, the position of east-west shortening, also retreated, which is indicated by the formation of foreland basin and fold and thrust belt. The fact suggests that thermal weakening of crustal rocks caused by the magmatic activities facilitated the east-west shortening in the foreland of the Andes (Ramos et al., 2002). Folding and thrusting, and seismic activities have been intense since the Pliocene both at the eastern margin of the Precordillera and in the Sierras Pampeanas.

In this structural geology field course, we have observed thrust faults and folds, which formed after the Miocene, presumably after the Pliocene. The localities of these outcrops and observed structures are mentioned below. In this talk, the occurrences of these structures formed by the east-west shortening at each outcrop will be shown with slides.

1. Uplift of the Achala Devonian batholith, west of Cordoba
2. Thrust faults and associated pseudotachylite in the Los Tuneles shear zone, west of Cordoba
3. Thrust front (thrusting of the Miocene foreland sediments upon the Quaternary terrace gravel) accompanied by a fold and thrust belt at the eastern margin of the Precordillera (Sierra de las Penas), west of San Juan
4. Thrust faults which truncate the Quaternary terrace, artesian flowing well and repetition of the stratigraphy of basement rocks at the eastern margin of the Precordillera (Sieera de Zonda, Sierra de Villicum), west of San Juan
5. Reactivation of the boundary between the Cuyania and Chilenia terranes, west of Uspallata
6. Fold and thrust belts in the Aconcagua area, the main Andes