

Back-arc opening and across-arc tectonics in Cenozoic Japan

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Multiple check on U-Pb and Pb-Pb age spectra was conducted for detrital zircons in various Cretaceous sandstones in SW Japan. Their comparison revealed a long-distance (more than 200 km across the arc) transportation of a Cretaceous back-arc sedimentary package into the fore-arc domain during the early Cenozoic, almost coeval to the back-arc spreading of the Japan Sea. The overall configuration of the Cretaceous subduction-related arc-trench system in Japan is preserved in the current distribution of the relevant orogenic components, i.e., the coeval set of accretionary complexes at trench (the Sanbosan and North Shimanto belts), high-P/T meta-ACs along the Wadati-Benioff zone (the Sanbagawa and Shimanto metamorphic belts), arc batholiths (Ryoke-Sanyo and San-in belts), and fore-arc basin strata (Ryoseki-Monobegawa and Izumi groups). We identified unique age spectra of detrital zircons in the Cretaceous sandstones in the Atogura area in the northern Kanto Mountains, and the Maana area in western Shikoku. These strata occur on the south of Median Tectonic Line of SW Japan as allochthonous klippen. The results of U-Pb dating by LA-ICPMS showed that these sandstones have common age spectra with 4 major age groups; i.e., 120-150 Ma (Early Cretaceous), 170-200 Ma (Jurassic), 250-300 Ma (Permian), and 1600-2200 Ma (Paleoproterozoic), with minor amounts of much older grains up to 2900 Ma (Archean). This age spectrum is quite unique, when compared with other coeval Cretaceous fore-arc and/or intra-arc sandstones in Japan. The Early Cretaceous grains were obviously derived from a proximal source to the depositional site, likely the Cretaceous volcanic arc of the Ryoke-Sanyo belt in SW Japan. The dominant grains of the Jurassic and Permian ages were likely derived from coeval plutonic belts in the provenance, whereas the Paleoproterozoic grains were probably derived from the continental blocks in East Asia with crusts of the corresponding ages, such as the North and South China blocks. Except for the Cretaceous arc source, the occurrence of Jurassic and Permian granitoids is extremely rare in the major parts of Japan, and the Paleoproterozoic crust is totally absent in Japan.

The analyzed sandstones from the Atogura and Maana klippen are remarkably different from other coeval fore-arc sandstones, whereas they clearly show similarity to those of the Tetori/Jinzu groups in the Hida belt. The Cretaceous sandstones of the Atogura/Maana klippen were primarily deposited with a close link to the Hida belt. The tectonic emplacement onto the present position immediately above the Cretaceous high-P/T meta-ACs occurred likely during the Paleogene-Neogene time, probably in relation with the Miocene rifting of the Japan Sea. This study provides the first evidence for the material transfer from the back-arc to fore-arc on the order of 200-300 km across the arc.

Keywords: SW Japan, Cretaceous, detrital zircon, U-Pb dating