Reconstruction of Cretaceous continental arc-trench system in Japanese Islands as a basis for Cretaceous paleoenvironmental studies

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As the Japanese Islands are situated in an active convergent margin, their geologic structure is very complicated in general. The distribution of their Cretaceous strata reflects the tectonic setting of the present four arc-trench systems: Kuril, Northeast (NE) and Southwest (SW) Japan, and Ryukyu. The tectonic configurations of the two main systems (NE and SW Japan) during the Cretaceous have not yet been resolved due to some epigenetical geologic processes. This is because the Cretaceous strata had been affected by post-Cretaceous tectonic movements, e.g. the Japan Sea opening, the subduction of Philippines Sea plate, the collision of the Izu-Ogasawara arc since the Early Miocene. Furthermore, the Cretaceous of Japan is widely eroded and covered by thick Neogene to Quaternary volcanics and sediments.

As a first premise we reconstructed the configuration of the NE and SW Japan arcs before the Japan Sea opening (ca. 25 Ma: Late Oligocene). A continuous distribution of Early Miocene volcanics parallel to a trench suggesting the volcanic front position at that time reminds us that the two major arcs formed a single straight continental arc (paleo-Japan arc). The distribution gap at their boundary zone, called Northern Fossa Magna region and Tonegawa Tectonic Line, was caused by right-lateral displacement of the paleo-Japan arc during the Early Miocene Japan Sea opening. Our reconstructed paleogeographic map indicates that the Outer Zone of SW Japan, the trench-side region of the Median Tectonic Line correlates in position to the offshore Pacific subsurface of NE Japan. The Cretaceous volcanic front inferred from the distribution of Cretaceous volcanics appears nearly in the same position as during the Early Miocene. This strongly suggests that the relative position of the continental arc during the Cretaceous was almost the same as during the Late Oligocene.

Mostly non-marine Lower Cretaceous strata are sporadically distributed in separated small intra- and back-arc basins around the volcanic arc, though they are also limited along the Pacific coast in NE Japan. On the other hand, mainly marine and subordinately fluvial strata are sporadically occurring but continuously distributed along the Pacific coast, offshore the Pacific subsurface in NE Japan, and along the southern end of the Inner Zone and the Chichibu Belt of the Outer Zone in SW Japan. Their stratigraphy and sedimentary environments are broadly correlated as forearc basin fills throughout the paleo-Japan arc. The stratigraphic ranges cover all of Cretaceous stages entirely, though the stratigraphic range and geographic distribution of each formation is limited.

These Cretaceous strata record a wide variety of sedimentary facies and biofacies changes from offshore to shallow-marine to continental, reflecting paleoenvironments and basin tectonic settings such as backarc/intra arc, forearc and trench slope-trench basins along the single continental arc-trench system between the Eurasian Plate and the subducting Paleo-Pacific oceanic plate.