

Maizuru back-arc sea closure: Permo-Triassic boundary tectonics in East Asia

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The Maizuru sea, which was located on the East Asian continental margin, formed as a back-arc basin during Early Permian with the deposition of the Maizuru Group, a massive mudstone-dominated thick sedimentary cover. The Maizuru back-arc sea closed during the Permo-Triassic (P-T) boundary as a result of the subduction of the basement crust of the basin under the East Asian continent and led to the formation of the present-day Maizuru Terrane located in Southwest Japan, where the rocks of the back-arc basin are currently exposed. The closure of the Maizuru sea took place in an ambiance of acute tectonic activity characterized by two pulses of debris flow which led to the deposition of the Tonoshiki breccia (with intermittent sandstone layers) constituted of two types (Type I and Type II) and made up of differently-sized extremely angular clasts that were sourced from both sides of the basin. The U-Pb detrital zircon geochronology of the two types of the Tonoshiki breccia showed two major age peaks at ca. 275 Ma and ca. 268 Ma for Type I and Type II, respectively, with an estimated timing for deposition at ca. 259 Ma for Type I and ca. 251 Ma for type II. This revealed that the first debris flow event occurred at ca. 259 Ma and was followed by the deposition of the first type (Type I) of breccia, which is dominated by intermediate to mafic rock fragments supplied to the basin from the Yakuno Ophiolite of the Southern zone of the Maizuru Terrane. The second pulse of debris flow took place at ca. 251 Ma and generated the second type (Type II) of breccia which mostly consists of felsic shallow crustal materials sourced from the Northern zone of the Maizuru Terrane and the East Asian continent including the Korean Peninsula. The intense tectonic activity that accompanied the closure of the Maizuru back-arc sea and which was recorded by the above-mentioned provenance switch, is also evident from the extensive hydraulic fractures observed in the Tonoshiki breccia. Prehnite-pumpellyite veins and several calcite-filled fractures were found in the breccia-dominated Tonoshiki Formation and its underlying units. The absence of such fractures in the overlying Triassic Fukumoto Formation constrains the closure of the Maizuru back-arc sea to the P-T boundary which is an important period when many tectonic events took place in East Asia and in the world in general.