

## Thesis Summary

Tectonic processes during Maizuru back-arc basin closure: Geochemical,  
geochronological, and structural approaches

(地球化学・地質年代学・構造地質学的手法に基づく舞鶴背弧海盆閉鎖プロセスの解明)

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The aim of this research is to have a precise understanding of the evolution of back-arc basins and more specifically to unravel the tectonic processes that occur during their closure. The paleo Maizuru back-arc basin (BAB) which opened in Early Permian and closed possibly during the Permo-Triassic (P-T) boundary at the East Asian continental margin, is the target to elucidate those back-arc basins closure-related processes. Petrological, petrographic, mineralogical, geochemical, and geochronological studies have been carried out on the sedimentary rocks of this basin in order to achieve the above-mentioned goals. The present research work is organized into eight chapters. Chapter 1 introduces the research with brief information on back-arc basin studies in general with a special emphasis on the Maizuru BAB. It states the problem and the main objectives of this research. Chapter 2 presents the geological background of the Maizuru BAB whose rocks are exposed in the present-day Maizuru Terrane. The Maizuru Terrane is subdivided into three zones, the granitoid-dominated Northern zone, the mafic and ultramafic ophiolitic basement rock-dominated Southern zone, and the sedimentary rock-bearing Central zone. Chapter 3 focuses on the different methods and techniques used in this study. Petrological and petrographic studies were conducted through field investigations, optical and scanning electron microscopy (SEM). The mineral chemical compositions were determined by electron microprobe analysis (EPMA), and the geochemical characteristics were defined using X-ray fluorescence (XRF) and inductively coupled plasma mass spectrometry (ICP-MS). Laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) was used for geochronology. Chapter 4 describes the main rock types in the study area (Mimasaka-Doi, Okayama) and their field relations. The massive mudstone-dominated Maizuru Group, the breccia-dominated Tonoshiki Formation, and the Yakuno Ophiolitic group of rocks are the three main units found in the study area. Chapters 5 and 6 focus on the main outcomes of this research. Chapter 5 presents the mineralogical, geochemical characteristics, and the zircon U-Pb geochronological data of the breccia and its surrounding units. The results show that Tonoshiki breccia is a product of submarine slope failure and both

types of the breccia contain mudstone clasts that have similar mineralogical and geochemical features as the mudstones of the Maizuru Group. Chapter 6 deals with the characteristics of Tonoshiki breccia and shows that it is affected by several calcite-filled fractures and sediment-filled fractures, which are evidence of hydraulic fracturing. Chapters 7 and 8 discuss the main results of this research and address the problems stated in the introduction. The major findings and conclusions of this research revealed that Tonoshiki Formation is the topmost unit of the Maizuru Group and the rock record during the closure of the Maizuru back-arc basin in Late Permian time. The closure of the basin occurred during a period of intense tectonic activity as a result of the subduction of the basin basement under the East Asian continent and was characterized by two episodes of debris-flow events at ca. 259 Ma and ca. 251 Ma, which led to the deposition of extensively fractured breccia. The study of closure-related tectonic processes for back-arc basin has its global importance as similar basins were formed and eventually closed in similar tectonic setting. Therefore, such understanding of the tectonic development of the Maizuru area in southwest Japan leads to the understanding of the East Asian continental margin during Permo-Triassic boundary, and also help to decipher the closing stage mechanisms and structural style of back-arc basins in the world. Very few studies on paleo back-arc basins have been published and this leads to the very limited amount of information regarding those closure-related mechanisms. The current study therefore provides additional and important information or ideas about the late development stage of back-arc basins. The results obtained from the present study suggest that coarse-grained sediments such as breccia and processes such as slope failure, sediment provenance switch from opposite sides of the basin, intensive fracturing, and veining could constitute typical sedimentary and structural rock record of back-arc basin closure.