

Study of brecciated process of iron and carbon-bearing veins of the Akiyoshi-dai drilled samples

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1. Characteristics of the Japanese islands: The present Japanese Islands has less young volcanic rocks compared with much sedimentary rocks (ca.60% in volume). This is mainly because the Paleozoic basement rocks (including the Akiyoshi limestone) are remained from ocean-floor aggregates before formation of the Japanese island-arc (ca.15Ma) characteristically.

2. Characteristics of the Akiyoshi-dai limestone: Japan Islands are geologically recently emerged from the ocean floor and situated North-South arc, though vast and old Akiyoshi sedimentary limestone is remained now on the plateau. This indicates that Main-land (West) mixed with different formation-time and locations is moved though ocean-floor movements before formation of the Sea of Japan.

3. Research results of Akiyoshi-dai drilling limestone samples (powder): The Akiyoshi underground samples (up to 250m in depth from the Kaerimizu site) drilled by the Akiyoshi Science Museum (at Kaerimizu, 250 m) show significant changes of 1) physical properties (structure and ESR signals) of powdered calcite minerals along the fossil reversal distributions [1-5], 2) elemental abundances of siderophiles from bulk XRF data analysis at the bottom of 243m in depth, and 3) re-crystallized calcite and minor contents of feldspars and quartz of the samples of the bottom (243m) and surface colored marble with iron contents [4].

4. FE-SEM study of the thin and massive drilled samples: The brecciated drilled thin-section samples prepared in the United States show the following the FE-ASEM and Raman data:

1) Shallow sample (50 m in depth) with small calcite decomposition and few carbon-grains. 2) Medium sample (160 m) to deep (217 m and 243 m) with nano-crystals of separated carbon grains, re-crystallized calcite and halite. 3) Massive deep samples with nano-carbon (the Raman peaks of high-pressure carbon) and shocked nano-calcites (related with artificial products) [3-5].

5. Comparison with overseas Paleozoic limestone: Four overseas Paleozoic samples are investigated in this study as follows [5]: 1) Carlsbad limestone of 300Ma (New Mexico) of coral reef origins with deep underground cave. 2) Sierra Madera Permian limestone (Texas) of impacted shuttered cone with significant siderophiles elements. 3) Alamo breccias 367Ma(Nevada) of shocked quartz and fine calcite without clear impact crater. 4) Santa-Fe breccias 350Ma(New Mexico) of shocked quartz and limestone with fluid-tube texture and separated nano-carbon grains.

6. Proposed formation of the Akiyoshi-dai limestone: Breccias of the Akiyoshi-dai Kaerimizu (243m in depth) are not simple sediments, but impact-related materials contains complicated activities of significant siderophiles, nano-carbon separated from limestone and two types of calcite (re-crystallization and nano-calcites), which cannot be explained only by simple volcanic and earthquake events, but also impact processes of remained sea-floor and weathering after uplift ground) [4, 5] .

7. Summary: The Paleozoic Akiyoshi-dai limestone-breccias which are remained in the Japanese islands with different time-location blocks show clear example of various colors, minerals and compositions with different eras and places on ocean-floor process, where they are difficult to explain by general shock-wave processes (earthquakes and volcanoes). In this study, oversea Paleozoic limestone investigations are compared with old limestone of the Akiyoshi-dai drilled samples.

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