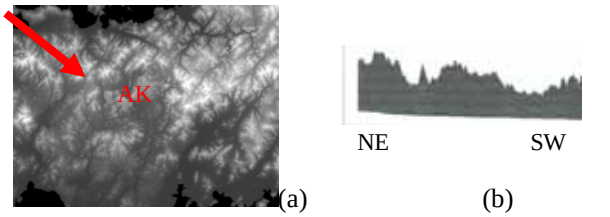
AKIYOSHI LIMESTONE BLOCKS TRANSPORTED BY THE P/T BOUNDARY EVENT TO JAPAN ISLANDS, Y. Miura and S.Tanaka, Institute of Earth Sciences, Faculty of Science, Yamaguchi University, Yoshida 1677-1, Yamaguchi , Yamaguchi, 753-8512, Japan. E-mail:yasmiura@yamaguchi-u.ac.jp

Introduction: The Akiyoshi limestone plateau with Shuhoudo Cave in Yamaguchi, Japan is the largest limestone blocks of Carboniferous to Permian Periods in Japanese islands which is the first location to discuss the formation of Japanese islands called as "Akiyoshi Orogeny in Japan" by Ozawa (1923)[1]. He found the "overturned structure of limestone blocks" from fossil record, and three-type mountain-range as geosyncline orogeny, which is here considered to be "similar impact crater structure" of two rims (nonlimestones) and central peak (Akiyoshi limestone). All scientific papers from 1923 [1] are mainly limestone blocks formed by geosyncline (formed at the present location), lagoon [2], sea-mount by plate tectonics [3], or continental-drift movement from southern location with overturned structure by collision [4-6]. Recently, senior author reports new model of Akiyoshi limestone by using satellite images and shocked materials of carbon and Fe-Ni- bearing grains in the Akiyoshi limestone blocks (fossil record from 350Ma to 250Ma ago) as mixing process of limestone islands by the Permian-Triassic (P/T) geological boundary event at the Equator region to form the present Akiyoshi limestone group separated to China and Japan (Hiraodai, Taishakudai and so on) [6]. Purpose of the present paper is to make report of the Akiyoshi limestone blocks originally formed by impact event and transported by continental-drift system finally to show similar impact structure with central peaks of limestone blocks.

Shape and size of Akiyoshi crater structure: The Akiyoshi limestone blocks are elongated structure of 16km EW by 8km NS (130km^2 in volume) as central location as the plateau. The present satellites (JERS-1, OPS/SR images) and topographic image analyses reveal the crater shape is 25kmNS x 28km WE in size, and 300m (in present geography) and 700m in depth (difference between the highest mountain and the lowest valley) . However Paleozoic Akiyoshi limestone blocks surrounded by Paleozoic sediments of the Ota, Beppu and Tsunemori Groups are included in the crater structure with crater shape of different rocks in the west (the Paleozoic groups) and the North and East (by the Mesozoic sediments of Mine and Atsu Groups). This indicates that Akiyoshi crater structure is formed during later tectonics of Yamaguchi-opening by separation to 90 degree at north of the Akiyoshi Limestone block (not by large active volcano, or direct impact crater) though there are two half crater-shape on bending rims of the West and East directions (Fig.1).

Unsolved problems of the Akiyoshi limestone Blocks: There are many unsolved problems for the



(a) (b)

Fig.1. Computer imag photos of the Akiyoshi district, Yamaguchi, Japan. AK: Akiyoshi. (a) Overview of Akiyoshi crater structure, (b) surface profile of NE-SW direction as latitude which is the crater structure with central peaks [6].

Akiyoshi limestone blocks as follows: 1) Old and thick limestonses (from 350 Ma to 250Ma in fossil record) are remained as unweathered . 2) There are no thermal changes, but mechanical breakings of limestone are found especially on the rims of the blocks. 3) Fossils of limestone are formed at equator area, which are not the present middle latitude of Japan. 4) Paleozoic rocks are coexisted with Paleozoic Akiyoshi limestone. 5) Almost all limestones after P/T event are completely missing. 6) Akiyoshi limestone is overturned with missing fossil layer. 7) Limestone at dilled core at 243m is strongly deformed structure [4,5]. 8) The same age limestone was distributed all in Japan separately. The above many unsolved problem cannot be explained by geosyncline (formed at the present location), lagoon [2], sea-mount by plate tectonics [3]. Even we use model of continental-drift movement from southern location with overturned structure by collision [4-6], we cannot explain problems of the above 1), 2), 4),5), 6), 7) and 8) .

Impact materials within the crater structure: Impact materials of "black carbon" with Fe-Ni bearing grains formed by meteoritic impact [6] can be found at all geological boundary of the Carboniferous and Permian Periods in the Limestone blocks in the crater. We found that high pressure type chaoite, Fe-Ni-Co minerals (taenite, tertrataenite) from meteorite as minor minerals in 243m drilled core. This suggests that red layer of 243m in drilled borehole at the East of Akiyoshidai (National Park) reveals relict of impact–related event. Similar results are found at surface breccia of black and white as impact-related materials of Fe-Ni-Co bearing grains. Almost all calcites of the Akiyoshi Limestones show distorted cell.

Continental-drift model accelerated by impact events: Akiyoshi limestone blocks are formed at

Equator as China north and south blocks in 340Ma, and only northern China block with Akiyoshi limestone blocks abruptly changed to northern latitude for ca. 6,000km apart at 250Ma of PT impact event. China northern blocks with shift velocity of ca.20cm/year is twice than normal plate movement velocity. This suggests that Akiyoshi limestone blocks are formed at southern hemisphere near Equator at first impact crater structure, and this layered limestones were overturned at shallow sea-water near equator by the big impact events at Permian-Triassic Boundary (PBT) formation, followed by buried into the deeper interior with Paleozoic sediments, which are transported with China northern blocks. This movement is completely different with previous plate tectonics theory of the Akiyoshi limestone drift, as follows: Sea-mount of Akiyoshi-dai limestone should be short age, but limestones with long period of ca.100Ma are layered. This should be explained other model of large basin structure as in Mexican impact crater structure in the shallow sea. There is no present crustal plates with sea –mount in the Paleozoic period at Equator (ca.350Ma ago), though there is other type subduction front at northern side of the north China blocks (cf. Fig.2). Main difference used here between continental drift and plate tectonics on limestone transportation is that continental drift moves with small crustal plates mainly induced by impact events, whereas plate tectonics are only stressed on movement from ridge front which is indirectly related with impact event to the sea bottom.

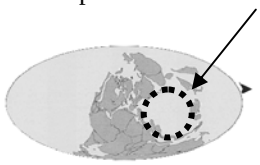


Fig.2. China northern blocks with primordial Akiyoshi limestone blocks (shown by arrow) moved abruptly to northern hemisphere at ca.250Ma by PTB impact event.

Formation process of Akiyoshi limestone blocks: The following new impact-related materials are found in this research project: Fe-Ni-Co grains are found in surface and drilled 243m borehole at Akiyoshi basin structure. High pressure type carbon (induced by impacts on limestone) are found in 243m borehole. The following impact –related process at equator of the PTB impact event can be found at Akiyoshi limestone blocks. All limestones are disappeared after Permian period, stopped by PTB impact event in the sea. Almost all limestones are broken mechanically in sea water, by shock wave in sea-water. Limestone blocks are not suffered directly from PTB impact, but overturned by shock wave in the sea water. Limestone blocks buried in the same Paleozoic sedimentary rocks in the interior to cover against further melting or weathered. The following impact-related process at present northern hemisphere is induced by Takamatsu MKT impact event [8]. Buried Akiyoshi limestone blocks are increased with other western part islands of Japan, induced by Takamatsu MKT impact event at 15.3Ma [8]. Increased islands are still observed in western Japan as Mountain and valley relation by weathering process. Akiyoshi buried limestones are completely weathered from high land which we cannot see it now except bottom of weathering height of Akiyoshidai plateau as following process: 1)Formation at near Equator (<350Ma ago). 2) Sedimentation of layered Akiyoshi limestone (within crater-like structure) at Equator from 350Ma to 250Ma ago. 3) PTB impact event at Near Equator, 250Ma ago. 4) Overturned structure with broken parts followed buried into deeper places with Paleozoic sedimentary rocks. 5)Moved to northern hemisphere with China Northern blocks as continental-drift. 6) Takamatsu MKT impact event (15Ma ago) to form Japan islands with buried Akiyoshi limestone blocks. 7)Weathering process to sow present Akiyoshi limestone structure with survived central peak.

Summary: New model of impact and continental drift of Paleozoic rocks at the PTB event is applied to the Akiyoshi limestone blocks with shocked materials of Fe-Ni-Co-bearing grains formed at the Equator region. The Akiyoshi overturned limestone blocks are formed in the sea by PT shock wave process, an shifted by the present location with continental-drift system finally to show "similar impact structure with central peaks" of limestone blocks sediments by increased process by Takamatsu MKT impact [4-7].

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