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Origin of the 2.3 Ga diamictites in the Meteorite Bore area, Western Australia.

Mami Takehara[1*], Shoichi Kiyokawa[1], Kenji Horie[2], Kazumi Yokoyama[3]

[1]Kyushu University, [2]National Institute of Polar Research, [3]National Museum of Nature and Science

The Meteorite Bore Member is a part of the Turee Creek Group, the uppermost part of the Mount Bruce Supergroup. The depositional age of the Meteorite Bore Member is constrained to 2.4-2.3 Ga by the zircon U-Pb age of the ca. 2449 Ma Woongarra Rhyolite of the upper part of Hamersley Group (Barley et al., 1997) and of the ca. 2209 Ma Cheela Springs Basalt of the Wyloo Group (Martin et al., 1998). The Meteorite Bore Member comprises the diamictites, and the dropstones and striated clasts in the diamictites suggest that the Meteorite Bore Member is composed of the deposits of the glacial origin (Trendall and Blockley, 1970). Moreover, the similar deposits were discovered in the Huronian Group, Canada and the Transvaal Group, South Africa, which are the evidences of the early Proterozoic "Snowball earth" event (Martin, 1999). The purpose of this study is to understand the composition and provenance of the Meteorite Bore Member, to discuss the land surface and topography in the Pilbara Region around 2.3 Ga. Therefore we investigated the lithology and age of the Meteorite Bore Member, cropped out in the Meteorite Bore area.
The Meteorite Bore Area is located in the south limb of the Hardey Syncline in the southern Pilbara Region because of the 2.0 Ga Capricorn Orogeny, the collision between the Pilbara Craton and Yilgarn Craton. Accordingly, the axial-planar cleavages are distinguished in the whole area.
The Meteorite Bore Member is mainly composed of poor sorting and mud matrix-supported conglomerates. The conglomerates are highly deformed and the matrix is highly foliated but the grains are well preserved. The conglomerates consist mainly of 64 to 256 millimeter in diameter and the maximum is about 300 millimeter. They are mainly composed of felsic volcanic rocks and middle to coarse-grained sandstones, and the minor amount of BIF and chert grains.
Based on the whole rock analysis of the grains of felsic volcanic rocks in the Meteorite Bore Member and the Woongarra Rhyolite using the XRF, all samples have the major element composition in the rhyolite field. As to the trace element compositions of the samples, the spider diagrams of N- MORB normalized trace element show the same pattern.
The detrital zircon analysis from the matrix of the diamictites by U-Pb dating using SHRIMP showed the provenance of the Meteorite Bore Member. The 17 grains were available to measure. The 5 grains of them were in the range of 2420-2450 Ma, and the 6 grains were in the range of 24 60-2490 Ma. The range of their detrital zircon ages includes the age of the ca. 2449 Ma Woongarra Rhyolite. The other 6 grains were scattered over the range from 2530 to 2860Ma.
Based on the lithology and dating, the diamictites of the Meteorite Bore Member contain the Woongarra Rhyolite origin. Therefore it is probable that the Woongarra Rhyolite, which is situated below 1,500 meter from the Meteorite Bore Member, exposed on the land surface when the diamictites were accumulated. In this way, it suggests that the northern area of the Pilbara Craton had risen by at least 1,500 meter before the Capricorn Orogeny.

Reference:
Barley, M.E. et al, 1997, Nature, 385, 55-58
Martin, D. McB. et al, 1998, Economic Geology, 93, 1084-1090
Trendall, A.F. and Blockley, J. G., 1970, Geological Survey of Western Australia Bulletin 119,366

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