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Palaeoclimatic conditions during Neoproterozoic: case study from Iran & Australia (Tasmania)

Mohammad Hossein Adabi and Mina Khatibi Mehr

Shahid Beheshti University, Faculity of Earth Sciences (Department of Geology), Tehran, Islamic Republic Of Iran (minakhmehr@gmail.com)

Petrographic, elemental and isotopic composition of Neoproterozoic least- altered dolomites at Renison mine (Western Australia) and Gachin (Zagros, Iran sections have been studied to determine the climatic conditions during Neoproterozoic.

The Neoproterozoic Era was a time of repeated continental glaciations, including one of the Earth's most severs refrigerations (Kaufman etal., 1993). Three major phases of glaciations (Sturtian glacial, ∼715 Ma, Marinoan glacial, ∼630 Ma and Gaskiers glaciation ∼580 Ma) were widespread during Neoproterozoic (Hoffman etal., 2004; Knoll etal., 2004; Calver etal., 2004). In this period, extensive low latitude ice sheets and glacio-marine deposits were reported (Kasting, 1992; Williams, 1993). Thus, the Neoproterozoic world has the most extensive glaciation in the earth's history and truly icehouse climate (Hambrey, 1992).

Widespread glaciogenic deposits of Neoproterozoic age occurs in a belt of sedimentary basins across central Australia (Brookfield, 1994) and also in Tasmania (Claver etal., 2004, Kendall etal., 2007). The association of dolomite with tillites, and particularly the presence of glacial erratics in these sediments, indicates cold water conditions throughout most of the Neoproterozoic time. In western Tasmania thick diamictite units and the presence of dropstones in laminated dolosiltite have been reported by (Calver, 1995; Calver etal., 2004). The carbon isotope chemostratigraphy gives an age range of between 570-800 Ma for the Renison carbonates (Adabi, 1997). These ages range corresponds to Gaskiers and Sturtian glacial respectively. The calculated palaeotemperature of seawater during the Neoproterozoic, considering w=-6%■ (Tucker, 1986), and least-altered dolomites 18O values of -1±1%■ indicates that the seawater temperatures was around 12º±4ºC (Land equation) in Tasmania.

Petrographycally, dolomicrites in Gachin (Zagros) section in Iran are interpereted as least-altered dolomites, as original depositional textures are well preserved and show little evidence of recrystallization and diagenetic reorganization. Only small percentages of Neoproterozoic dolomites of Zagros and central Iran are synsedimentary or formed during early diagemesis. Most dolomites are medium to coarsely crystalline, due to an increased amount of diagenetic alteration. Geochemical evidence also confirms that dolomicrites are the least-altered dolomites in Gachin, Zagros, Iran. These dolomicrites have high values of Mg, low values of Fe and Mn, high values of Sr and Na and heavy 18O values and fall within the cold water dolomite fields of Renison, and least-altered Neoproterozoic dolomite of California. This dolomite probably formed in cold water conditions, which corresponds to the cold climatic condition during Neoproterozoic.

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(Land equation). Cold water marine dolomite from other geologic periods, such as Barremian –age sediments with temperatures as low as 15ºC, and from the West Florida Neogen cold deep water marine dolomite with palaeotemperature of 4.5 to 12ºC, have been reported recently (Flood and Chivas, 1995).