



## Carbonate formation and alteration in the salt diapir caprock (Paskhand salt diapir, Southern Iran)

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The eastern Zagros Fold and Thrust Belt (ZFTB) in Iran includes a salt tectonic province with roughly 130 salt-gypsum diapirs emerging within the Neoproterozoic-Early Cambrian Hormuz Complex. The diapirs in the ZFTB differ in composition and in their distribution of exposed caprock mélanges (CRMs). Although there are numerous studies focused on the geochronology and geochemistry of igneous rocks as exotic blocks associated with CRMs, the geochemistry, and petrography of carbonates remain to be systematically investigated. The Paskhand Diapir is a unique little diapir with no visible salt rock at the surface. Its CRMs consist of massive and layered gypsum, carbonate, marlstone, and siltstone, which are associated with diabase exotic blocks. The carbonate paragenesis is being examined. A grey fine crystalline dolomite is considered to have originated early during diagenesis from a Neoproterozoic marine environment. Other carbonates can be distinguished on the basis of their microspar, and spar cements. In general, the major minerals are dolomite and calcite, with quartz and iron oxides being in minor abundance. Important trace minerals are pyrite, sphalerite, talc, mica, K-feldspar, malachite, bassanite, rutile, chlorite, and apatite. Their abundance in mineral assemblages is variable, also depending on the locality within the diapir. Later-stage calcitic veins frequently cross-cut through micritic and microspar cemented lithologies. Lithological mapping shows that the edge of the diapir commonly exhibits a greater variety of mineralization modes with extensive recrystallization as compared with its core. The  $\delta^{13}\text{C}$  values of dolomite range from  $-7.0$  to  $+2.7$  ‰ V-PDB. This range indicates that seawater was the principal source of reactants for dolomite precipitation, although with some inorganic carbon derived from organic matter oxidation. The  $\delta^{18}\text{O}$  values of dolomite range from  $-0.55$  to  $-13.13$  ‰ V-PDB, reflecting a temperature fractionation effect. The carbonate formation temperatures of the Hormuz complex (both veins and host rock) were determined for the first time by using the  $\Delta 47$  (paleo)thermometer in dolomite.  $\Delta 47$  values range between  $0.422 \pm 0.015$  and  $0.287 \pm 0.015$  ‰, indicating diagenetic closure temperatures of between  $116.4 \pm 11.7$  and  $271.2 \pm 32.5$  °C. An intensive interaction of hydrothermal fluids with the host rock during localized carbonate recrystallization is thus evidenced.

These results show that a correct interpretation of the mechanism(s) of carbonate alteration is critical for reconstructing the history of diapirism in the area. We hypothesize that carbonates in CRMs were reworked through a series of events largely influenced by thermochemical sulfate reduction (TSR) at  $T \geq 110$  °C.