Factors controlling the formation of silica and pyrite minerals in skeletal fragments in the Shishtu 2 Formation (Early Carboniferous), at Howz-e-Dorah area, southeast of Tabas

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Abstract: The (Early Carboniferous) Shishtu 2 Formation at the study area is composed of a shallowing upward sequence. Skeletal packstones consist of crinoids, brachiopods, bryozoans, trilobites, corals and rare foraminifera. The carbonates of this formation have undergone a complex diagenetic history and the most diagenetic events are silicification and pyritization. The complexity of silicification in these limestones is further demonstrated due to selectivity of silicification of different faunas. Based on morphology, four fabric types are distinguished in silica including microcrystalline quartz, spherulitic chalcedony and slightly megacrystal and euhedral quartz. The observed correlation between skeletal fragments and quartz replacement types (QRT) shows that skeleton microstructure may control QRT. The silicification of the skeletal grains in this study occurred along thin solution films where skeletal calcite dissolved and silica precipitated. The brachiopods, corals and crinoids are the most susceptible organisms to silicification. The presence of impurity of Mg$^{2+}$ in the composition of skeletal grains (e.g., brachiopods and crinoids) may be the controlling factor for their susceptibility for silicification. Diagenetic pyrite in the limestone of the Carboniferous in this area exhibit as euhedral pyrite which occurs as singular euhedral crystals. These may occur after the death of faunas and during burial diagenesis. This process is strongly dependent on the redox potential (dysaerobia to anaerobia) and availability of the required elemental ingredients (Fe and S) in the burial realm.

Keywords: Silicification; pyritization; primary mineralogy; microstructure; skeletal grains; Shishtu Formation; Tabas.

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