The study of chert nodules in the Sardur Formation, OzuhKuh Mountains (North Tabas)

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Abstract
The aim of this study is to analyze chert nodules in the Carboniferous sediments (Sardur Formation) in Seinal of Ozuh-Kuh (North Tabas). In this area, cherts occur as irregular nodules in the sandstone matrix and pendants. These chert nodules are oval and hand-shaped with clear lateral contacts. The color of nodular cherts is dark gray and black due to impurities such as organic matters and relics of carbonates. These cherts commonly contain relic component of other carbonate grains such as dolomite. The host rocks of all chert nodules in this study are Nwmnsite (holocristobalite and quartzite). Dolomite rhomboid are present within chert nodule but there is no evidence that the nodular cherts formed by the replacement of a dolomitic precursor. Glimps of skeletal grains, such as crinoids, are preserved in the chert nodules and show diagenetic origin. Chert nodules have various forms but their larger dimension is parallel to bedding surfaces. Based of petrographic studies, four fabric types are distinguished in these nodules including microcrystalline quartz, megapores, (mosaic quartz), chalcedony porphyry and spherulitic chalcedony.

Key words: Chert nodules, Carboniferous, Ozuh-Kuh, Sardur Formation

Introduction
Chert is a hard, dense, and compact siliceous rock, consisting of micro or cryptocrystalline quartz crystals that contain impurities such as carbonate, iron oxides and organic matters. The purpose of this study is to analyze chert nodules in the Carboniferous sediments (Sardur Formation) in North Tabas (Fig.1). Chert can provide a window to the original composition of the sediment, the diagenetic history and the biota of the host rock due to its low susceptibility to further diagenetic ablation (Maliva, 2001). In this area, chert replaced limestone as nodules, thin layers and irregular masses. The form of the replacement is probably controlled by the porosity-permeability distribution of the carbonate, the hydrologic flow, and various factors affecting nucleation (Kanath, 1979). Chert nodules in limestone rocks have been documented in a variety of geological settings. These nodules formed during early diagenesis and are common in pelagic chalky limestones (Zijderveld, 1959), as well as shallow marine settings, where they are related to mixing zones (Gioli and Chafiz, 1965).

In this area, chert nodules are as potato and avoid shaped with several centimeters in diameter with coalesced fracture and replacing the host rock along bedding planes (Fig.1a). The color is commonly dark gray and black due to impurities such as organic matters and relics of carbonates. Nodular cherts might grow outward from a nucleation site. Most specimens of chert nodules occur in bioclasts. In this section, chert nodules
display a large range of petrographic textures that are related to the manner in which they formed and burial history (Hesse, 1989, 1990; Camerl, 1993). The thin sections have been stained by alizarin R-S and also studied by SEM and EDX. The degree of silicification is variable, for example from nearly complete with slightly inclusions of carbonate minerals to uncompleted as mixed of microquartz and microspar.

Small carbonate rhombohedra are commonly present in chert nodules examined (Fig.4b). Cherts of carbonate or skeletal grains precursors in chert nodules clearly show that most chert nodules formed from replacement of carbonate rocks. One important relationship observed under the microscope is between silicification and compaction. In the sectors of thin section, skeletal grains are completely replaced by silica and another sector unsilicified or partially silicified carbonate grain have a deformation that occur due to compaction.

Mineralogy of carbonate rhombohedra
Using staining and EDX analysis, rhombohedra are dolomite that shows zoning (Fig.2). Based on EDX analysis, dark line in zones of dolomite is organic carbon (Fig.3). Figure 2 show SEM views of dolomite grain and the EDX spectrum indicates the presence of all major elements typical of dolomite (Ca and Mg). In this example, the peak height of Mg is similar to Ca.

Classification of silica texture in chert nodules
On the basis of their morphology, four major fabric types are identified:

1. Mega Quartz and Nodule quartz
Mega quartz is coarse grain (>20μm), when the grain size increases towards the inner side of the pore, it gives a dusty texture. Nodule quartz is similar to dusty quartz (Fig.4c). This usually is colorless and may contain inclusions. They are equigranular, unaligned grains, grain size progressively increases from the margins to the center (similar to dusty calcite). Extinction is commonly uniform and irregular extinction occurs where the fabric merges into chaledony.

2. Chaledony overgrowth
This fabric is commonly colorless with shades of brown and usually forms rims around silicified allochthones (Fig.4d). In crossed nicoles, it appears as fibrous and each fiber having an extinction position approximately normal.

3. Spherulitic Chaledony
This fabric is colorless with shades of brown and concentric bands of inclusion that are sometimes developed within some spherulites (Fig.4e). Chaledony matrix is often a pore-filler rather than replacement. This is supported from the evidence of the sample illustrated, in that there are straight boundaries that are characteristic of radial fibrous and pore filling cements (Adams et al., 1984).
4. Microcrystalline granular quartz

This fabric is colorless with slightly inclusion and is common showing patchy distribution. They are fine-grained (<20µm) and equigranular texture (Fig. 4f).

This quartz replaces micrite grains. Cleft fabric in Figure 9 indicates that chart is associated with microbial structures. It shows that the organic matter would be acted by adsorbing the silica in the fluid (Raviolo et al., 2009). This occurs in the case of alteration during early diagenesis, when the bacterial activity and oxidation of the organic matter are still active (Main and Land, 1991).

Conclusion

In Sardar Formation, chert nodules are varied in shape but they are discoid or egg-shaped masses with thin charges from a few centimeters to a few tens of centimeters. They commonly occurred along bedding strike. Irregular shape, presence of irregular patches of carbonate and presence of silicified fossils in some nodules are evidence for a replacement origin.

In chert nodules from Sardar Formation, dolomite rhombohedra were always found that contain zoning. Due to presented dolomite rhombohedra in the chert nodules and absent in the surrounding carbonate rocks, they are clearly showing evidence of diagenetic origin. Under microscope, silica in nodular chert show different types of fabrics that is micro quartz mainly replaced carbonate grains, the megaspilitic and euhedral chaledony are mainly every filling cements.

References


Fig. 1. The location map of study area.

Fig. 2. SEM view and EDX spectrum of carbonate rhombohedra.

Fig. 3. SEM view and EDX spectrum of dark line in nodal detritus.
Fig. 1 (a) Chert nodules in Suan-er Formation (Ortoli-Kind). (b) Exfoliated dolomite rhomb in chert, XPL. (c) Mosaic quartz, cased by mica quartz, drusy texture, XPL. (d) Chalcedony, overlay, XPL. (e) Spherulite chalcedony associated with dolomite rhombohedra and calcite, crystalline quartz, XPL. (f) Micrystalline granular quartz associated with patch of organic materials, XPL.