Nanoobjects microscopy

Morphological Features of Silica Particles in Siliceous Sedimentary Rocks

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Nonclastic siliceous sedimentary rocks (e.g. diatomite, opoka, tripoli) are formed by a fossil fragments and/or mineral particles and composed of 70 - 90% of silica (opal) with admixtures of clay, carbonate, zeolites, metallic oxides etc. Diatomite mainly consists of biogenic opal-A. Tripoli and opoka mainly consist of opal-CT.

SEM study of silicilithes from some deposits in Ukraine revealed main morphological features of opal-A transforming into opal-CT. Eocene Kharkiv "opoka" (age 40±4 Ma) formed by diatomites frustules and their fragments (well recognized by honeycomb or cellular texture) is composed of amorphous opal-A. But neomorphic rosettes and embryonic lepispheres of 1-2 μm in diameter of opal-CT and their clusters are also observed (Fig. A). Eocene Kirovohrad tripoli (age 40±4 Ma) shows mono- and polilepispheric texture, with the size of each opal-CT lepispheres being 8-14 μm (Fig. B). Cretaceous (Alb-Senomanian) Lviv opoka (age 100±5 Ma) consists of opal-CT lepispheres of 5-10 μm size and contains admixtures of neomorphic zeolites (Fig. C). Figs. B-C illustrate bladed opal-CT lepispheres with regular 70° or 180°-70° angles giving evidence of the twinning law of tridymite; those were formed as a result of low-temperature recrystallization of biogenic opal-A into opal-CT. Transformation kinetics depends on temperature, parameters of host environment, time etc. Specific surface area of nonclastic siliceous sedimentary rocks ranges from 15 m^2/g for rock to 200 m^2/g for treated material. Their low cost, availability, excellent biocompatibility, thermal stability, and chemical inertness make diatomite, tripoli, opoka attractive materials for numerous applications ranging from absorption to pharmaceutics.

Fig. Microtexture: diatomite (A), tripoli (B) and opoka (C)