

## **Quartz Types in the Mowry Formation (Cretaceous), Rocky Mountains, USA**

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### **ABSTRACT**

The Mowry Formation (Cretaceous) is a well-known siliceous mudrock of the Rocky Mountain region. The character of quartz in this formation has been investigated using integrated light microscopy, X-ray elemental mapping, and cathodoluminescence imaging. MicroCT (x-ray) imaging was also performed on companion samples. Detrital quartz takes the form of extrabasinal detrital silt (some with transported overgrowths) and radiolaria (now replaced). Authigenic quartz includes replacements of skeletal debris (radiolaria and other allochems), minor overgrowths on detrital quartz and replaced radiolaria, pore-fillings within intragranular pores of allochems, and matrix-dispersed microquartz. The matrix-dispersed microquartz is composed of equant crystals that are mostly in the range of 1 to 2  $\mu\text{m}$  across and intergrown masses of these crystals. The microquartz has CL character similar to the overgrowths with which it is intergrown, supporting the interpretation that it is authigenic. The widely observed radiolaria are very poorly preserved by partial mineral replacements (quartz, dolomite, calcite, pyrite). We interpret dissolved radiolaria as the likely source of the overgrowths and microquartz, through a reaction pathway that entailed the formation of opal-CT Jepspheres that eventually recrystallized to quartz. The volume of microquartz within the mudrock matrix suggests that porosity was in the range of at least 25-30 percent at the time of initial silica precipitation. MicroCT difference images highlight the porosity and show extensive, discontinuous microcracks. These discontinuities are likely not open in the subsurface but demonstrate the high propensity for brittle failure, which is likely related to the grain-binding effects of the matrix-dispersed microquartz.