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SECONDARY PROCESSES IN THE FORMATION OF RIBBON BEDDED AND NODULAR CHERT IN THE MONTEREY FORMATION AT MUSSEL ROCK, SANTA BARBARA COUNTY, CALIFORNIA

A high-resolution geochemical and petrographic study of a continuous section across the opal-A to opal-CT transition zone of the upper “Clayey-Siliceous” member of the Monterey Formation at Mussel Rock, California, indicates significant secondary processes in development of ribbon bedded and nodular chert. Previous research has shown that local addition of silica is necessary to form siliceous nodules, but whether distinctive cyclic alternation of chert-shale couplets is a primary or diagenetic feature has long escaped resolution.

Burial diagenesis at Mussel Rock was halted by rapid tectonic uplift, exposing a succession of laminated diatomites overlying nodular cherts, and then ribbon bedded lithologies. Geochemistry suggests a fairly consistent primary ratio of silica to detritus (RSD) through the ~80 m-thick stratigraphic section, assuming that nodules required silica addition. The mean RSD decreases slightly from ~1.6 below the nodular horizon to ~1.4 in overlying diatomites. Markedly high nodular RSDs (mean RSD=4.6) and porosity-mass modeling support open-system chemistry in the formation of nodules. However, absence of differential compaction along the margin of nodules suggests that they formed “late”, after reaching maximum burial depth.

RSD varies from 0.7 to 2.1 in diatomite and from 0.3 to 3.1 in ribbon-bedded lithologies, a 50% increase in range. Mass-balance calculations for the diagenetic lithologies suggest these ratios reflect limited local solution transfer between beds enhancing the primary lithological variation, rather than *in situ* dissolution-reprecipitation of silica.

Elements normalized to aluminum indicate that Na exceeds Fe with respect to Al in diatomites, a relationship that is reversed at the base of the section. Also, Na, Fe, Ca, and Mg concentrations (with respect to Al) in ribbon bedded lithologies are relatively constant compared to in diatomites. Due to the presence of authigenic clays with euhedral hexagonal morphology, we interpret cation chemical signatures as associated with clay paragenesis in prograde burial diagenesis.