Burgess Shale Tales—Mud Volcanism and Chemosynthetic Communities on the Middle Cambrian Seafloor of Southeastern British Columbia

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Famous for exquisitely preserved “soft-bodied” fossils, the Middle Cambrian Burgess Shale of southeastern British Columbia figures importantly in discussions of early animal evolution associated with the “Cambrian Explosion”. Until recently, research has focussed mostly on the fossils, but sedimentological and structural observations reveal an intriguing story. Recent studies show that metre- to decametre-thick lithosomes composed of nearly pure clinochlore are relatively common in the Burgess Shale, at or near a fault contact with Cambrian platformal carbonates on the Kicking Horse Rim. Because clinochlore is a Mg-rich product of hydrothermal alteration of mafic minerals, it could not have been deposited by normal basinal sedimentary processes. We propose that it arrived at the Cambrian seafloor via mud volcanos. Seeping hydrogen sulfide-rich brines, arriving with the mud, fueled microbial chemosynthesis that, in turn, attracted animal communities now preserved as localized concentrations of fossils. Regional dolomitization and ore emplacement including Pb-Zn and magnesite can also be explained by brine migration in a syngenetic hydrothermal system. The evulsed mud and brines were probably generated from serpentinization associated with subducting oceanic lithosphere along the north (now west) edge of Laurentia. Consequently, the Burgess Shale is not necessarily a “typical” marine shale, and most of its fossil assemblages do not represent “normal” distal shelf communities. Rather, the Burgess Shale records deposition in a mud volcano field and preserves the oldest known examples of chemosynthetic animal communities in the fossil record.