Mineral record of crustal evolution: The roles of episodic mineralization and preservational bias

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The mineral record of crustal evolution reflects both changing paragenetic processes and preservational biases through deep time. Dramatic changes relate to episodic mineralization associated with convergent margin metallogenesis during five intervals of presumed supercontinent assembly at ~2.8 to 2.5, ~1.9 to 1.7, ~1.2 to 1.0, ~0.6 to 0.5, and ~430 to 250 Ga, corresponding to assembly of Kenorland, Nuna, Rodinia, Pannotia, and Pangaea, respectively [1-3]. These intervals are represented by peaks in ages of zircon [4-6] and production of minerals of B, Be, Cu, Hg, and Mo [1] [2] [7-9]. Not only is mineralization enhanced in suture zones during collisional events, but also suture zones are more likely to be preserved.

Deposition of black shales, which are often employed as proxies for conditions at Earth's near-surface, has been episodic [10]. Significant intervals of Earth history, including those related to supercontinent fragmentation and increased rates of organic carbon burial, reveal enhanced production of black shale.

By contrast, sedimentary carbonate (Ca-Mg-Fe-Mn) deposits occur almost continuously in the rock record since ~3.5 Ga, implying that at least some formations both form and can be preserved through most of Earth history [11].

Important unanswered questions related to detrital minerals from the Hadean (> 4 Ga) include the timing and severity of the late heavy bombardment and the production and survivability of impact-generated mineralized hydrothermal zones [12].

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