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Antarctica, supercontinents and the palaeogeography of the Cambrian 'explosion'

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Laurentia is bordered by latest Precambrian-Cambrian rifted margins and must therefore have been located within a Precambrian supercontinent. Geochronologic and geochemical evidence indicates that it was attached to parts of the East Antarctic craton within the Rodinian supercontinent in the late Mesoproterozoic. The Mawson craton of Antarctica rifted from the proto-Pacific margin of Laurentia during the Neooproterozoic, colliding with the present 'southern cone' of Laurentia at ∼600 Ma along the Shackleton Range suture zone as Gondwana and Laurentia amalgamated to form the ephemeral Pannotia supercontinental assembly at the end of the Precambrian.
The abrupt appearance of almost all animal phyla in the fossil record is often colloquially referred to as the Cambrian 'explosion' of life on Earth. It is also named 'Darwin's dilemma,' as he appreciated that this seemingly mysterious event posed a major problem for his theory of evolution by natural selection. It coincided with a time of major marine transgression over all the continents. Although the metazoan 'explosion' is now seen as more protracted than formerly recognized, it is still regarded one of the most critical events in the history of the biosphere. One of the most striking aspects of the earliest Cambrian fossils is geographic differentiation. In particular, the first benthic trilobite faunas on Laurentia, ancestral North America, and the newly amalgamated southern supercontinent of Gondwana are distinctly different. This has led to the suggestion of an unknown vicariant event intervening between an ancestral trilobite clade and higher members that are represented in the fossil record, possibly one related to the breakup of a supercontinent.
Igneous rocks along the Panthalassic margin of Gondwana, including South America, southernmost Africa and the Ellsworth-Whitmore crustal block of Antarctica, and along the proto-Appalachian margin of Laurentia indicate that final separation of Laurentia from Antarctica occurred just prior to the first appearance of trilobites in the fossil record. This event would have separated the Olenellid trilobite fauna of Laurentia from the Redlichiid fauna of Gondwana by opening a major oceanic connection between the developing Iapetus and pre-existing Pacific ocean basins with profound global environmental effects at the time of the Cambrian 'explosion,' including expansion of continental shelves. The paleogeographic settings of the two great transgressions of the Phanerozoic, the Cambrian and Cretaceous, are remarkably similar. Both seem to have involved comparatively rapid increase in ridge crest length within the ocean basins.