Illawarra Reversal: The fingerprint of a superplume that triggered Pangean breakup and the G-LB (Permian) mass extinction

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The Permian magnetostratigraphic record demonstrates that a remarkable change in geomagnetism occurred in the Late Guadalupian (Middle Permian; ca. 265 Ma) from the long-term stable Kiaman Reverse Superchron (throughout the Late Carboniferous and Early-Middle Permian) to the Permian-Triassic Mixed Superchron with frequent polarity changes (in the Late Permian and Triassic). This unique episode called the Illawarra Reversal probably reflects a significant change in the geodynamo in the outer core of the planet after a 50 million years of stable geomagnetism. The Illawarra Reversal was likely led by the appearance of a thermal instability at the 2,900 km-deep core-mantle boundary in connection with mantle superplume activity. The Illawarra Reversal and the Guadalupian-Lopingian boundary event record the significant transition processes from the Paleozoic to Mesozoic-Modern world. One of the major global environmental changes in the Phanerozoic occurred almost simultaneously in the latest Guadalupian, as recorded in 1) mass extinction, 2) ocean redox change, 3) sharp isotopic excursions (C and Sr), 4) sea-level drop, and 5) plume-related volcanism. In addition to the claimed possible links between the above-listed environmental changes and mantle superplume activity, I propose here an extra explanation that a change in the core's geodynamo may have played an important role in determining the course of the Earth's surface climate and biotic extinction/evolution. When a superplume is launched from the core-mantle boundary, the resultant thermal instability makes the geodynamo's dipole of the outer core unstable, and lowers the geomagnetic intensity. Being modulated by the geo- and heliomagnetism, the galactic cosmic ray flux into the Earth's atmosphere changes with time. The more cosmic rays penetrate through the atmosphere, the more clouds develop to increase the albedo, thus enhancing cooling of the Earth's surface. The Illawarra Reversal, the Kamura cooling event, and other unique geologic phenomena in the Late Guadalupian are all well explained as consequences of the superplume activity that initially triggered the breakup of Pangea. The secular change in cosmic radiation may explain not only the extinction-related global climatic changes in the end-Guadalupian but also the long-term global warming/cooling trend in Earth's history in terms of cloud coverage over the planet.