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Detection of cosmogenic material in deep-sea sediments based on platinum group element (PGE) abundances

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Snowball Earth events are widely recognized to have occurred in both the Palaeoproterozoic and Neoproterozoic. All present-day animal phyla appeared following the Marinoan-Snowball Earth, which is the last recorded global glaciation. The primary objective of this research is to determine the cause of this Snowball-Earth event, which is likely associated with the evolution of life. Three models that attempt to explain the onset and termination of Snowball-Earth events are: (1) episodic decrease of greenhouse gases, (2) changes of the albedo of the Earth accompanied by the arrangement of the continents, and (3) an increase in cosmic-ray bombardment to the Earth due to Starbursts in the Milky Way Galaxy or transects of Earth through nebula.

Based on recent investigations, the effects of cosmic fluxes on the Earth are estimated here through the measurement of the abundances of platinum group elements (PGE) in sediments.

Pelagic sediments composed of interlayered shale and/or mudstones are optimal for PGE-abundance analysis because of their low sedimentation rate. Pelagic sediments used for PGE-abundance analysis in this investigation are comprised of bedded shales and/or mudstones sampled from the accretionary complex of Anglesy-Llyen, U.K. The Anglesy-Llyen reportedly was formed by an accretionary orogeny in the Neoproterozoic. During the geological survey, samples were acquired from a pelagic sedimentary sequence, which records late Cryogenian to early Cambrian sedimentation. A relatively high PGE concentration and its flat C1-normalized PGE pattern indicate possible high cosmic fluxes on the Earth during the emplacement of this sequence when compared to average upper continental crust composition.

Keywords: PGEs, deep-sea sediment, Cambrian