

MIS025-05

Room:104

Time:May 24 09:30-09:45

Iridium anomaly, Ni-rich spinels, and microspherules in Upper Triassic chert of the Mino Terrane, Central Japan

Honami Sato^{1*}, Tetsuji Onoue¹, Tomoki Nakamura², Takaaki Noguchi³, Yuichi Hatsukawa⁴, Takahito Osawa⁴, Toh Yosuke⁴, Koizumi Mitsuo⁴

¹Kagoshima University, ²Tohoku University, ³Ibaraki University, ⁴Japan Atomic Energy Agency

An important ~30 Myr interval during the Late Triassic is marked by the formation of several large impact structures on Earth, including the 100-km-diameter Manicouagan crater in Canada, which is one of the largest known Phanerozoic impacts. Although the age of the Manicouagan structure is well constrained by U-Pb dating (~215.5 Ma), deposits containing its ejecta are known only from southwestern Britain. Here, we report that an Upper Triassic chert in Japan, deposited within the Paleo-Pacific (Panthalassa) pelagic basin, contains Iridium anomaly, Ni-rich spinels, and microspherules that are characteristic of impact ejecta.

Microspherules were discovered from a claystone layer (~5 cm thick) in an Upper Triassic bedded chert succession of the Sakahogi section, Mino Terrane, Japan. An analysis of radiolarian fossils reveals that the claystone layer is correlated with the early to middle Norian stage of the Upper Triassic. The base of the layer contains 10-15% (by rock volume) green microspherules. Microspherules range in size from 200 to 300 microns. Synchrotron X-ray diffraction analysis indicates that the microspherules are composed mainly of clinoclore. Some microspherules contain a high proportion of small, euhedral to subhedral crystals of oxidized Ni-rich spinels. They are distinguished from typical igneous spinels by high contents of NiO and Fe³⁺. The geochemical signals of extraterrestrial impact are recorded in the claystone layer. Examination of the clay layer using a multiple gamma-ray analysis system after neutron activation reveals that microspherules and Ni-rich spinels occur associated with an iridium anomaly, which levels comparable with those at the Cretaceous-Paleogene boundary. A scanning X-ray analytical microscope analysis shows high concentrations of siderophile elements such as nickel and cobalt, which would be expected from an extraterrestrial source.

The discovery of Iridium anomaly, microspherules, and Ni-rich spinels in early to middle Norian claystone from Japan suggests an important sedimentary record of an extraterrestrial impact in the Late Triassic. Although the Manicouagan impact structure would appear to be related to deposition of the claystone, based on an age for the crater of ~215.5 Ma, the chemical composition and mineral assemblage of the microspherules differ from those of hollow illitic microspherules reported from southwestern Britain, which are considered to be derived from the Manicouagan. Additional research is needed to confirm the source for the early Norian claystone layer in Japan, as well as to constrain the origin of the clinoclore microspherules and Ni-rich spinels.