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Beginning of Dinosaur Magnetism

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We propose new interdisciplinary genre, named as Dinosaur Magnetism, which relates to geomagnetism, rock magnetism, paleontology, sedimentology, rock mechanics in the earth science, and to analyze relation between deformation caused by Dinosaur and detailed magnetic measurements on sedimentary layer with Dinosaur Footprint, to elucidate reliability of paleomagnetism recorded in the sedimentary layer, geomagnetic field in the Dinosaur ages, acquisition of detrital remanent magnetization during formation of footprint by Dinosaur, evolution of Dinosaur, continental drift and living environment of Dinosaur.

We have examined the Dinosaur footprint sample, collected from Kitadani Formation of Tetori Group in Katsuyama City of Fukui Prefecture, central Japan, for the Dinosaur Magnetism.

The fossil bones of Dinosaur were reported from the Kitadani Formation, as Fukuiraptor kitadaniensis with body length of 4.2m of carnivorous Theropods, Fukuititan nipponensis with 10m total length of herbivorous Sauropods, Iguanodon with 4.7m total length of herbivorous Ornithopods.

We measured fine and very fine grained sandstone layer bounded by the thin mudstone layers with footprint of the right leg of Theropods. Because the mud layers were exfoliated easily with water, we use kerosene. The base of the sample was plastered with gypsum for precise oriented cutting. The 2cm cubic samples for the measurements of magnetism were cut from the sample.

We found a significant magnetization of gypsum, 10 times stronger than the sandstone samples, and then we removed the gypsum from the samples of basal part before magnetic measurements.

We measured natural remanent magnetization NRM after 10 mT step alternating field demagnetization, anisotropy of magnetic susceptibility under 22 micro T, anhysteretic remanent magnetization ARM of 29 micro T and 40 mT after 10 mT step alternating field demagnetization with Automatic Paleomagnetic Processor NP2 of Metoba.

We examined demagnetization pass of NRM for sample of side by side and significant divisions with the courses of demagnetization pass, which means the sample had not been remagnetized with uniform secondary magnetization.

The divisions are correlated closely with the deformation of the Dinosaur footprint, especial rising part between the second and the third toes, in which the NRM has uniform directions and the directions are not changed with demagnetization, contrasted with the surrounded parts.

The part is loaded by the total weight of the Theropods Dinosaur as much as several tons, and the sandstone layers were bent few centimeters under the weight centered around the part. The surface of the rising was covered by the web of the leg, and the sediments are estimated to be pressed with several tons weight. The void in the sediments had been vanished and the magnetic particles had been fixed in the sediments. The NRM of the part can be thought as a record of the geomagnetism at the time of the Dinosaur walking at 100 Ma.

The further study of the measured result will be able to realize the mechanism of the deformation and magnetization which are useful to understand the behavior of the Dinosaur. The paleomagnetic direction is useful for the evolutionary trend of Dinosaur.

Keywords: Dinosaur, Theropods, footprint, paleomagnetism, Tetori Group, gypsum