

Environmental magnetic study of hominid fossils-bearing sediments in Sangiran, Java, Indonesia

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Detailed environmental magnetic analyses were carried out on a 14-m sequence of black clay around the tuff T11 in the top-most part of the Sangiran (Pucangan) Formation in Sangiran, central Java. Vertical changes of rock magnetic parameters of ARM, SIRM, soft-IRM, HIRM, and S-ratio were measured at 10 cm intervals. Based on the results of IRM component analysis and thermomagnetic experiments together with the rock magnetic parameters, the sediment sequence is separated into two types of zone. The whole part of the sequence commonly includes ferrimagnetic minerals of magnetite and maghemite, and paramagnetic minerals which are decomposed to form magnetite above 350 degrees C. Another ferrimagnetic mineral of pyrrhotite, partly observed, contributes to the zonation. All the characteristic features of the rock magnetic changes are explained by the presence/absence of pyrrhotite and relative content of paramagnetic minerals. SEM and TEM observations reveal existence of framboidal pyrite throughout the sequence. The zone characterized by pyrrhotite (pyrrhotite zone) lies from 5.8 m below T11 up to 0.3m above it, overlain by no pyrrhotite zone of about 5 m thick. The boundary from pyrrhotite zone to no pyrrhotite zone at about T11 well agrees with the lower boundary of the zone yields hominid fossils. We propose the following two models of sedimentary environment changes, based on the rock magnetic results. A lake filled with high salinity water suddenly changed to a fresh water lake or a brackish water lagoon (salinity decrease model), or marine (high salinity preservation model). Such a change may be caused by climate changes like precipitation increase and/or a sea level change. The environmental change occurred at T11 have probably triggered formation of a habitat in Sangiran where homo erectus settled for more than 300 kyr.