拡張型磁気緩和による年代決定法の石垣島サンゴ津波石への応用

佐藤 哲郎 [1]; 中村 教博 [1]; 後藤 和久 [2]; 熊谷 祐穂 [3]; 外崎 貴之 [4]; 長濱 裕幸 [5]
[1] 東北大・理・地学; [2] 東北大・災害研; [3] 東北大・理・地球科学; [4] 東北大・理・地学; [5] 東北大・理・地学

An extended magnetic relaxation dating to tsunamigenic coral boulders in Ishigaki Island, Japan

Tetsuro Sato[1]; Norihiro Nakamura[1]; Kazuhisa Goto[2]; Yuho Kumagai[3]; Takayuki Tonosaki[4]; Hiroyuki Nagahama[5]
[1] Earth Science, Tohoku Univ; [2] IRIDeS, Tohoku Univ.; [3] Earth Science, Tohoku Univ.; [4] Earth Science, Tohoku Univ.; [5] Earth Sciences, Tohoku Univ.

Identification of an isolated boulder displaced and eventually transported by tsunamis plays a crucial role in the assessment of the occurrence of paleotsunami events. One of the most important evidence to the understanding of past tsunami events is to accurately date them from boulders. In Ishigaki Island, Japan, coral boulders that had been transported by tsunamis were distributed on the beach and land areas. In previous researches, large numbers of radiocarbon dating for coral boulders revealed the multiple tsunami events during past 2500 years. Although the first deposited age of a coral boulder could be established by using radiocarbon dating, there is a lack of information for subsequent transported ages. A viscous remanent magnetization (VRM) dating method can be used to date any geological event that results in significant movements of a rock. If a magnetic-mineral bearing rock is moved or re-oriented, the magnetism of the smaller magnetic grains re-aligns to the direction of the ambient magnetic field with time. This phenomenon is well known as Neel's (1949, 1955) single-domain (SD) relaxation theory. Pullaiah et al. (1975) derived a time-temperature (t-T relation) relation by assuming Neel's (1949, 1955) theory of magnetite. In principle, an experimental combination of short relaxation time and high temperature for removing VRM can determine the unknown relaxation time (tsunami age) at room temperature. Sato et al. (2014) applied VRM dating for comparing the radiocarbon age of these boulders. However, the age determined from t-T relation showed older age than radiocarbon dating for the same boulders. Recent work has shown that departures from Neel's theory can generally be attributed to VRM carried by coarse magnetic grains because their magnetization responds much more slowly. A natural rock contains many magnetic grains, with a wide variety of sizes and shapes, described by grain distribution. In an aggregate of the distribution, the relaxation form has been explained by a stretched exponential function. Thus, we reanalyzed published VRM decay data by stretched exponential law, and the results provided a reasonable fit to the experimental data. Furthermore, the extended t-T relation based on the stretched exponential has shown to be effective for experimental results of coral boulders.