Viscous remanent magnetitization of tsunamigenic boulders and the age of tsunami events

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Along some coastlines in Japan, there are erratic boulders apparently emplaced by tsunamis. The key to understanding of past tsunami events is the ability to accurately date the emplaced age of boulders. Although radiocarbon is one of powerful tools for dating boulders, subsequent movements and non-organic rocks (sedimentary rocks and volcanic rocks) cannot be dated. To overcome this problem, we use viscous remanent magnetization (VRM). Viscous remanent magnetization (VRM) partially overprints original magnetization in rocks displaced by paleotsunami events. 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 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. We tested this hypothesis to tsunamigenic boulders consisted of coral limestone in Ishigaki Island, sand stone in Beppu bay and welded tuff in Sanriku coast. The demagnetized paths of all samples have VRM turning points, and their demagnetization temperatures are compatible or higher value of the Neel's hypothesis.

Keywords: tsunamigenic boulder, viscous remanent magnetization, time-temperature relation

