Instability of Natural Remanent Magnetism of Rocks

By N. KAWAI

Geological Institute, Kyoto University

Geological evidence and experimental results have given sufficient confirmation for the fact that the natural remanent magnetic polarization of rock (abb: N.R.M.) is not always stable throughout the geological time, but by the renewed application of the geomagnetic force upon the specimen, the direction is changed even within a short period. The manner in which the change proceeds with time has closely been watched since these several years. The results illustrated in the Fig. 1 and

The time-change of N.R.M. of rocks.

Fig. 2 are those of the typical time-changes of N.R.M. of rocks, which soon after the sampling have been kept in laboratory with fixed orientation, the geomagnetic field being applied to the specimen in the direction nearly perpendicular to that of the original N.R.M. *in situ*. The changes, in most cases, have taken place in such a manner that the direction of remanent polarity tends to approach towards the magnetic field.

The stability and instability tests of rocks through the geological time up to the present were put into practice as follows. Many pieces of pebbles in conglomerate were sampled and the directions of their N.R.M. were measured. The polarity is estimated to be stable when these pebbles have retained the random directions of N.R.M. with which the pebbles had been put into the stratum. Whereas, it is concluded to be meta-stable when the direction of the N.R.M. of the pebbles have followed, or at

Table I—A Igneous Rock

Rock name	Locality	Direction of N.R.M.	Stability	Age
Andesite	Nara	Normal	meta-stable	lower Plio.
Dolerite dyke	Nara	NE72° dip 32°	stable	
Andesite	Kyoto	Normal	unstable	
Andesite	Kyoto	Reverse	meta-stable	
Basalt	Hyogo	Reverse	stable	
Basalt	Hyogo	Normal	meta-stable	
Andesite	Hyogo	Normal	meta-stable	
Andesite	Aomori	Reverse	stable	
Basalt	Toyama	Reverse		
Andesite	Osaka	Reverse	stable	
Andesite	Osaka	Reverse	meta-stable	
Andesite	Osaka	Reverse	meta-stable	
Basalt	Osaka	Reverse	meta-stable	
Dacite	Osaka	Reverse	meta-stable	
Sanukite	Osaka	Normal	stable	
Andesite	Osaka	Normal	meta-stable	
Andesite	Osaka	Normal	meta-stable	
Pitch stone	Osaka	Normal	meta-stable	
Dacite	Nara	Reverse	stable	Mio.
Andesite	Nara	Reverse	stable	Mio.

Table I—B Sedimentary Rock

Rock name	Locality	Direction of N.R.M.	Stability	Age
Ordinary Sediment	Boso	Normal	unstable	Pleisto.
Sand	Boso	Normal	unstable	Pleisto.
Clay	Boso	Normal	unstable	Pleisto.
Clay	Osaka	Normal	unstable	Lower
Azuki tuff	Osaka	Reverse	meta-stable	Pleisto.
Clay	Osaka	Normal	unstable	Pleisto.
Ordinal Sediment	Boso	Normal	unstable	Plio.
„	Boso	Normal	unstable	Plio.
„	Boso	Normal	unstable	Plio.
„	Boso	Normal	unstable	Plio.
„	Boso	Normal	unstable	Plio.
„	Boso	Normal	unstable	Plio.
„	Boso	Normal	unstable	Plio.
Tuffaceous Sediment	Boso	Reverse	meta-stable	Lower
Clay	Boso	Normal	unstable	Plio.
Volcanic Sediment	Boso	Reverse	meta-stable	Mio.
Shale	Boso	Normal	meta-stable	Mio.
Shale	Boso	Normal	unstable	Mio.
Sand	Boso	Normal	unstable	Mio.

least have had a tendency to follow, that of the geomagnetic field. However, when we could detect any appreciable change in the direction of N.R.M. by the repeated measurements in laboratory, it is concluded to be unstable. Thus the igneous and sedimentary rocks hitherto observed by us are classified into three kinds of groups, namely, stable class, meta-stable class and unstable class, the locality and the observed data of N.R.M., are tabulated in Table I with special reference to the above mentioned stability.

It should be noticed that the major part of the tertiary sediments reveals to be unstable except several volcanic sediments with reverse N.R.M. *e.g.* Azuki tuff in Ôsaka basin (Lower Pleistocene), tuffaceous sediments in Bôsô basin (Lower Pliocene) *etc.*. On the other hand, greater part of eruptive rocks is classified either to stable or meta-stable class and the N.R.M. is considered to be better in stability as compared to that of the sediments. Several unstable cases aside, the data of eruptive rocks are in favour of interpreting the geomagnetic history.