Persistent shallow inclination of TAF in the Philippines: a paleomagnetic study of the young volcanic rocks in the Luzon island.

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The nature of the time averaged field (TAF) and the paleosecular variation (PSV) have been studied since the concept of paleomagnetism began. Although knowledge on these has developed significantly, there is still much to be done before ancient geomagnetic behavior can be compared with the present geomagnetic field at the same level. Recent trials on the spherical harmonic expansion of the TAF unraveled many interesting features of geomagnetism, but the number and distribution of the data sites are still insufficient and uneven. Here we report the paleomagnetism of volcanic rocks from the southern part of Luzon Island, Philippines, which will fill the gap between the data points in the Pacific and Indian Oceans.

The Philippine Island arc system is surrounded by several subduction zones, and is, therefore, characterized by many beautiful volcanoes. Although most of these are still not undated, many are known to be fairly young from morphology. Paleomagnetic samples were collected from 29 sites in the southern part of the Luzon Island using an engine drill. The stability of the natural remanent magnetization (NRM) was examined by progressive alternating field (AF) demagnetization of a few pilot specimens on each site. If the demagnetization diagram showed clear characteristic remanent magnetization (ChRM), the remaining specimens were demagnetized at the level showing the ChRM. As a result, we obtained paleomagnetic directions from 21 sites out of 29. They are classified into 13 normal, 7 reversed and 1 intermediate polarity. The quality of the resultant mean paleomagnetic directions is fairly good with most of the a95 around 3 deg.. Only one site has an a95 larger than 5 deg., which showed the intermediate direction, and it was rejected for the further secular variation study. The ensemble is characterized by shallow inclination (14 deg. shallower than GADF), circular direction distribution, and a large VGP dispersion (18.8 deg.). Those features are not thought to be the problem of statistical fluctuation, since they are also seen in the paleomagnetic study by Ishikawa et al. (2004), though their results have generally large errors probably due to their block sampling, The features might be attributed to the active tectonics of the studied area, but a couple of evidences suggest that they reflect the geomagnetic characteristics of the region. Shallow inclination is consistent with the ODP site 767, 768 and 769 results of Celebes and Sulu Seas. Analysis of historical geomagnetic measurements and present field values consistently show that inclination in this region has been and still is shallower then GAD. The mean declination was very close to 0 deg. in contrast with the deviated inclination. This may suggest that the Mongolian geomagnetic anomaly is a persistent feature of geomagnetism that continues for very long periods.