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Testing paleointensity determinations in a contact aureole of the Columbia River Basalt

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In order to confirm whether a remanent magnetization records an ancient geomagnetic field or not, directional paleomagnetic data are usually checked by several kinds of field tests such as a fold or reversal test in addition to demagnetization experiments in laboratory. However, any field test is not routinely applied for paleointensity data. Neither fold nor reversal test are applicable to intensity data in principle. Absence of reliable field tests for paleointensity leaves many of the paleointensity data obtained by the Thellier method in question, although complicated experimental procedures have been proposed and detailed criteria for data selection are adopted for laboratory data. Still one kind of field test might remain applicable for paleointensity data: a contact test.

We tried testing paleointensity determinations for the Mayview dike and its contact aureole of the Miocene Columbia River Basalt Group. The about 2 m wide Mayview dike intruded the N2 Grande Ronde Basalt, which is also a formation of the Columbia River Basalt Group. A one centimeter quenched glassy layer is observed along the dike contact. Two or three millimeter thick sliced specimens were prepared from the hand samples bounding the contact and thermomagnetic analyses were performed. Magnetic mineralogy rapidly changes even within a single hand sample both in the dike and the country rock. Glassy samples exhibit the low Curie temperature (˜150 deg.C) of titanium-rich titanomagnetite and maghemitization seems insignificant, whereas non-glassy specimens suffered somewhat maghemitization and the degree decreases with increasing the distance from the contact. The country basalt rocks show the Curie temperature (˜580 deg.C) of titanium-free magnetite for the nearest specimen to the contact and the Curie temperature decreases as leaving the contact.

Highly maghemitized specimens both from the dike and the country rock gave apparently quite low or sometimes negative paleointensity values. These anomalous values should be artifacts due to alteration during laboratory heating in our Thellier experiments. Low-field susceptibility values, measured at each temperature step of the Thellier experiments, also sharply rise with increasing temperature. We do not count on these anomalously low values any more. Glassy dike specimens showing insignificant maghemitization have relatively high paleointensity values which are still lower than the present geomagnetic field intensity. A basalt specimen nearest to the contact indicate a similar paleointensity value to those of the glassy dike specimens. This may suggest that the geomagnetic field intensity is recorded both in the dike and the country rock.

Keywords: paleointensity, Thellier method, field test, rock magnetism