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Absolute paleomagnetic intensity and tephrochronology: Absolute calibration of relative paleomagnetic intensity stacks

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Absolute geomagnetic paleointensities (APIs) have been estimated from igneous rocks, while relative paleomagnetic intensities (RPIs) have been reported from sediment cores. These two datasets have been treated separately, as correlations between APIs and RPIs are difficult on account of age uncertainties. We present a procedure for directly correlating APIs with RPIs of a RPI stack. Correlations between APIs and RPIs were conducted with virtually no associated age errors using both tephrochronologic correlations and RPI minima. Using the stratigraphic positions of tephra layers in oxygen isotope stratigraphic records, we directly compared the RPIs and APIs reported from welded tuffs contemporaneously extruded with the tephra layers. In addition, RPI minima during geomagnetic reversals and excursions were compared with APIs corresponding to the reversals and excursions. The comparison of APIs and RPIs at these exact points allowed a reliable calibration of the RPI values. In this study, we applied the Tsunakawa-Shaw method to 20 welded tuffs to increase API dataset. We obtained mean paleointensities for 16 of the 20 welded tuffs. Since eight of the 16 welded tuff units were correlated with the oxygen isotope stratigraphy, they can be added to the API data used in the correlation procedure. Combining these API data with the reported data, we correlated API data with RPIs from the PISO-1500 stack. For 13 correlation points, RPIs of the PISO-1500 stack showed a linear relationship with virtual axial dipole moments (VADMs) calculated from the APIs, indicating that the PISO-1500 stack has a linear relation to the axial dipole moment. The correlation procedure with increased API data can contribute to constraining the relation between RPI of a RPI stack and API and calibrating a RPI stack to absolute values.

Keywords: welded tuff, widespread tephra, absolute paleointensity, relative paleointensity, oxygen isotope stratigraphy