Orienting paleomagnetic drill cores using a GPS compass

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Azimuths of paleomagnetic drill cores are usually determined with magnetic compasses, and sometimes verified with sun compasses and back-sighting. Weather condition or geographical obstacles often do not allow to perform these subsidiary measurements. Strongly magnetized volcanic rocks can generate local magnetic field that deflects magnetic declination from the regional value. This time we tested a compact GPS compass that is directly mounted on a orientation device and cross-checked the azimuth values of volcanics drill cores by several orienting methods. When placing the GPS compass in a location with good visibility, the azimuth measurement showed excellent performance with the RMS of 0.44 degrees and the angles deviation with the sun compass were less than 2.5 degrees. To achieve such a high precision, we needed to wait about 5 minutes for initializing the RTK measurement and to ensure no obstacle in an angle of elevation more than 35 degrees. Actually orienting drill cores, the azimuths of the GPS compass were consistent with those of the sun compass and back-sighting, although an outcrop itself often acted as an obstacle for the GPS compass. The magnetic compass also provided accurate azimuths after correcting regional magnetic declination, but sometimes showed relatively large deviations more than 5 degrees. The amounts of deviation were variable from sample to sample even within a same single site. When collecting volcanic rocks for archeomagnetic studies, we need to verify the azimuth of each drill core by using a orienting method other than a magnetic compass.

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