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A 20–15 ka high-resolution paleomagnetic secular variation record from Black Sea sediments – no evidence for the 'Hilina Pali excursion' ?

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A geomagnetic field anomaly, characterized by low paleointensites and directional swings, has been widely observed at around 20 ka. The feature has been described as the Hilina Pali excursion that was originally reported from Hawaiian lava flows. However, the excursion is not yet well established, since no transitional virtual geomagnetic poles (VGPs) were recognized, except from a single site.

Aiming to comprehend the existence and extent of the Hilina Pali excursion, a very detailed high-quality paleosecular variation (PSV) record spanning from 20 to 15 ka could be obtained from sixteen sediment cores from the southeastern Black Sea. The age models are based on radiocarbon dating, stratigraphic correlation, and tephrochronology. Further age constraints were obtained by correlating four meltwater events, described from the western Black Sea, ranging in age from about 17 to 15 ka, with maxima in K/Ti ratios, obtained from X-ray fluorescence (XRF) scanning, and minima in S-ratios, reflecting increased hematite content, in the studied cores. Since the sedimentation rates in the investigated time window are up to 50 cm ka-1, the obtained PSVs records enabled a stacking using 50-year bins.

In the Black Sea, a directional anomaly at 18.5 ka, associated with pronounced swings in inclination and declination, as well as a low in relative paleointensity (rPI), is contemporaneous with the Hilina Pali excursion. However, VGPs calculated from Black Sea sediments are not located at latitudes lower than 60° N, which denotes normal, though pronounced secular variations. During the postulated Hilina Pali excursion, the VGPs calculated from Black Sea data migrated clockwise only along the coasts of the Arctic Ocean from NE Canada (20.0 ka), via Alaska (18.6 ka) and NE Siberia (18.0 ka) to Svalbard (17.0 ka), then looping clockwise through the Eastern Arctic Ocean.

Thus, the data from studied Black Sea sediments do not support the occurrence of a geomagnetic excursion in the Eastern part of the Northern hemisphere between 20 and 15 ka.