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Research Interests:

Behavior of the ancient geomagnetic field. Statistical analysis of paleomagnetic data. Applications of paleomagnetic data to geological problems.

The research during 2017 of myself and my students and post-docs was primarily focused on the study of the ancient geomagnetic field, focussing on the strength. Most of this work was done on the last 10,000 years using either archaeological (metallurgical slag, ceramics) or geological materials (lava flows). Three former post-docs in the Scripps Paleomagnetic Laboratory produced new constraints on the geomagnetic field variations of the Levant (Ben-Yosef et al., 2017), Georgia (Shaar et al., 2017) and China (Cai et al., 2017a,b). The bottom line is that we have confirmed the existence of a regional high (spike) observed in the Levant and Georgia. The evidence for a spike as far East as China is weak, however.

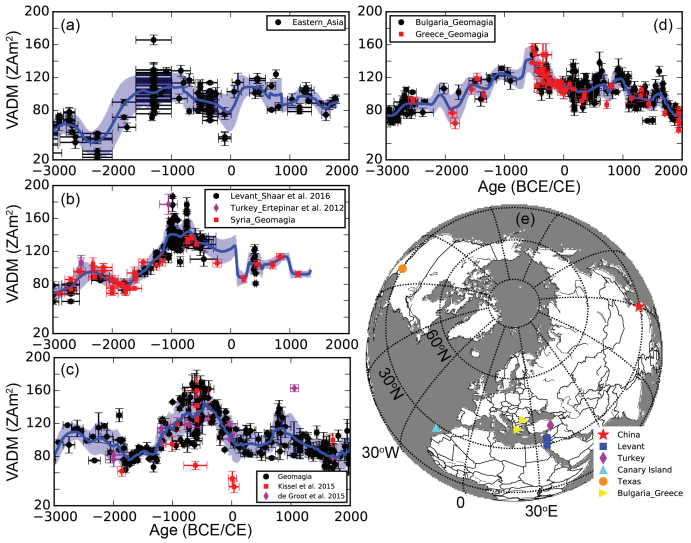

Figure 1: (A–D) Composite curves from representative areas: A includes only the eastern Asian data published recently (dois: 10.1029/2012JB009368; 10.1016/j.epsl.2014.02.030; 10.1016/j.epsl.2013.09.043); B includes all of the Levantine data compiled by Shaar et al. (2016; doi: 10.1016/j.epsl.2016.02.038) the data in Turkey published by Ertepinar et al. (2012; doi:10.1016/j.epsl.2012.08.039), and data in Syria from the Geomagia50.v3 database; C includes data within a 2,000-km-radius circle around Canary Islands from the Geomagia50.v3 database; D includes data in Bulgaria and Greece from the Geomagia50.v3 database. The selection criteria of including at least three specimens and with a SD of mean intensity less than 10% or 5 μT were applied on these data. (E) Projections of the locations related to geomagnetic spikes. [Figure from Cai et al. (2017a).]

On another related front, we made some progress toward the goal of better understanding the paleointensity method in general. Cai et al. (2017c) resampled the Hawai'i Scientific Drilling Project (HSDP) drill core previously studied using traditional methods by Laj et al. (2011; doi:10.1016/j.pepi.2011.05.007). Cai et al. analyzed the quickly cooled parts of the same lava flows using the approach outlined previously by Cromwell et al. (2015; doi:10.1016/j.pepi.2014.12.007). They found a systematic difference between the two approaches. Based on the successful results of the Cromwell paper, in which they recovered the field strength known from the International Geomagnetic Reference Field for Hawaiian lava flows by sampling glassy flow tops and applying strict selection criteria (CCRIT), it is

likely that the 'traditional' approach which targets flow interiors and a much looser set of criteria (PICRIT03) yields biased results.

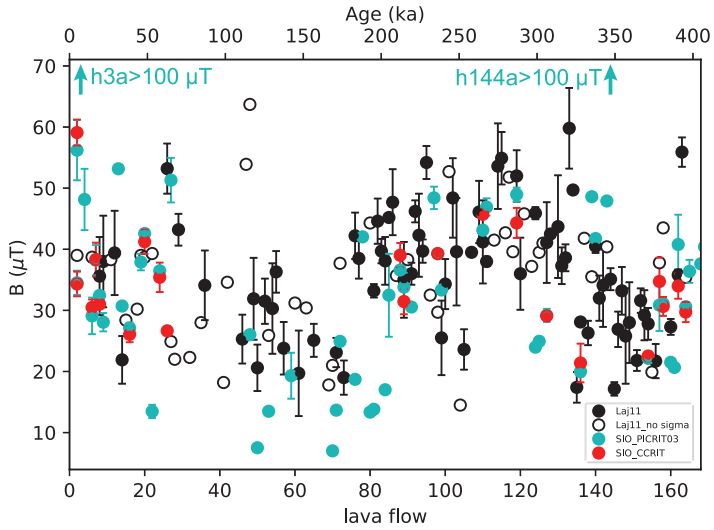

Figure 2: Paleointensities from Laj et al. (2011; doi:10.1016/j.pepi.2011.05.007) (black solid/open dots), SIO_CCRIT (red dots), and SIO_PICRIT03 (cyan dots) versus HSDP2 lava flows and ages. The open dots represent Laj data without paleointensity sigma uncertainty alues. The cyan arrows show two SIO_PICRIT03 results with intensities greater than 100 µT. [Figure from Cai et al. (2017c).]

Publications from 2017 *Archaeomagnetism:*

Cai, S.H., G.Y. Jin, L. Tauxe, C.L. Deng, H.F. Qin, Y.X. Pan, and R.X. Zhu, Archaeointensity results spanning the past 6 kiloyears from eastern China and implications for extreme behaviors of the geomagnetic field. Proceedings of the National Academy of Sciences of the United States of America, 14, 39-44., doi:10.1073/pnas.1616976114, 2017a.

Cai, S., Tauxe, L., Paterson, G.A., Deng, C., Pan, Y., Qin, H., Zhu, R., Recent advances in Chinese Archeomagnetism, Frontiers in Earth Science, 5-92, doi:10.3389/feart.2017.00092, 2017b.

Ben-Yosef, E., Millman, M., Shaar, R., Tauxe, L., Lipschits, O., Six centuries of geomagnetic intensity variations recorded by royal Judean stamped jar handles, PNAS, 114, 2160-2165, doi:10.1073/pnas.1615797114, 2017.

Shaar, R., Tauxe, L., Goguitchaichvili, A., Devidze, M., and Licheli, V, Further evidence of the Levantine Iron Age geomagnetic anomaly from Georgian pottery, Geophys. Res. Lett., 44, 22292236, doi:10.1002/2016GL071494, 2017.

Paleointensity:

Cai, S., Tauxe, L., Cromwell, G., Paleointensity from subaerial basaltic glasses from the Hawaii Scientific Drilling Project core (HSDP2) and implications for possible bias in the data from lava flow interiors, 122, 86648674, J. Geophys. Res., 2017c, doi:10.1002/2017JB014683.

Techniques:

Pablo Calv/'in, Juan Jos/'e Villala/'in, Antonio Casas, Lisa Tauxe, Sara Torres, pySCu: a new python code for analyzing remagnetizations directions by means of Small Circle utilities, Comp. and Geosciences,109, 33-42, doi: 10.1016/j.cageo.2017.07.002, 2017.