

Soil heterogeneity and surfactant desorption influence PAH distribution at a tar-contaminated site

KATJA HEISTER^{1*} AND ANA T. LIMA²

¹ Lehrstuhl für Bodenkunde, Technische Universität München, 85350 Freising-Weihenstephan, Germany (*correspondence: heister@wzw.tum.de)

² Department of Earth and Environmental Sciences, University of Waterloo, Waterloo, N2L 3G1, Canada

A remediation field experiment utilising electroosmosis and a non-ionic surfactant was conducted successfully at the site of a former asphalt production plant with a long-term tar-oil contamination [1]. After 159 days, the question arose whether the scattered distribution of the polycyclic aromatic hydrocarbons (PAHs) was due to soil's heterogeneity itself or to electroosmosis efficacy [1]. In this study, we assess the heterogeneity of the soil itself by analysing various soils samples with respect to amount and type of organic matter (OM) and PAH content. No relationship between either amount of OM, amount of aromatic carbon and PAH concentrations was observed. A relationship between PAHs and tar oil (represented by aromatic carbon) was *a priori* expected. Hence, soil's heterogeneity dominated this site rather than a considerable redistribution of PAHs during the electroosmotic treatment. Batch desorption experiments were then carried out with and without 1% Tween 80 on a representative sample of intermediate OM and PAH content and a sand sample with pure tar oil. The surfactant significantly enhanced PAH desorption and inhibited microbial degradation by forming micelles that entrap PAH molecules, making them unavailable to microorganisms. The PAH aqueous phase concentrations in the batch experiments were comparable to those obtained in the field experiment. Therefore, we conclude that the surfactant seems to be inevitable for the success of the remediation. As a consequence, in order to describe the transport of desorbed PAHs, micelles should be considered instead of single PAH molecules.

[1] Lima *et al* (2012) *Electrochim. Acta* **86**, 142-147.

Noise is now signal: Capturing the relevant from the distraction

MATTHEW T. HEIZLER¹

¹New Mexico Bureau of Geology, 801 Leroy Place, Socorro, NM, 87801, (matt@nmt.edu)

It is truly an exciting time for noble gas applications, and in the particular, geochronology precision is undergoing a revolutionary increase that allows incredible insight into complex geological processes. However this improvement is not immediately allowing for new discovery in geo and thermochronology. Removing the impediment towards new discovery lies in determining the causes for age scatter that is now recorded in most geological samples. Ultra-high precision age measurements (0.1-0.2 per mil) on individual volcanic crystals typically show ~0.2% standard deviation thereby reducing the MSWD to ridiculously high values. This leads to the question "What part of the scattered distribution records the geological event of interest?" Cases can be made for the young part, the middle part and the old part. Accurate young ages can be argued for by interpreting older results to be contaminated with excess and/or inherited argon. Excluding the young part in favor of the old part implies argon loss is the cause of inaccurately young grains. Perhaps our planet operates at a high standard deviation and natural variation caused by a host of mechanisms can be averaged such that the mean value of a scattered distribution remains the preferred choice for an event such as eruption. Determining the geological uncertainty for the time of eruption of a scattered distribution has no obvious value or statistical approach. Classical crosscutting relationships or stratigraphic order will always be the ground truth measure of accuracy and proper interpretation despite the level of precision reached in 2020. In addition to volcanology studies vastly improved spatial resolution at high precision will be the norm thereby increasing the utility of *in situ* analyses. Unfortunately, in many cases argon concentration profiles occur at a spatial resolution that will continue to confound our best current instrumentation. Despite the fact that new ultra sensitive, ultra clean multicollector mass spectrometers have jumped our science surprisingly forward, another leap will be required to achieve what every thermochronologist desires – an accurate concentration profile at a geologically relevant length scale. Lastly, the seemingly straightforward task to get geochronology labs intercalibrated remains a perplexing obstacle that inhibits productivity and causes unnecessary confusion. Because calibration and operation of the new and highly stable multicollector instruments will soon become routine, we as a community can have every expectation that this nagging issue will soon be a topic of the past.