

The structure and emplacement of the Rocche Rosse obsidian lava flow, Lipari, Aeolian Islands, Italy

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Satellite image analysis and field-based, structural mapping of the Rocche Rosse obsidian lava flow, Lipari (Aeolian Islands, Italy) provide important constraints on silicic lava flow emplacement and deformation.

High resolution satellite imagery of the flow surface identifies large scale structures, such as two well-developed flow lobes, pronounced lineaments which are prevalent along the extent of the flow, and prominent crescent-shaped ridges (ogives), typically 20-80 m in length, spaced 10-15 m apart and parallel to flow-frontal margins. Structural features measured include a pervasive foliation (flow banding), small-scale folding and flow ramps. Small-scale folding is superimposed on larger scale folding (parasitic folds), and recumbent folding is also apparent. In general, data on the ground match with structures inferred from the satellite image. Foliation and lineation orientation patterns vary across the flow, generally showing a flow parallel and flow perpendicular arrangement. A prevailing stretching lineation follows the large-scale lineament features, and surface folding is traceable along the surface ridges identified by the satellite image.

It is proposed that the structural features outlined formed over a progressive series of flow emplacement and deformation, from initial extrusion, constrictional and compressional forces, polyphase folding, brittle deformation and devitrification in the solid state. Variations in structural trends relate to areas of complex and progressive deformation. The Rocche Rosse lava flow is emplaced endogenously as a continuous, composite lava flow, with two flow lobes (formed as the advancing flow divided).

We show that while structures associated with obsidian lava flows are remarkably complex, they are inherently related and form sequentially during continuous effusion, preserve evidence for progressive deformation, and can be used to decipher mechanisms of obsidian flow emplacement, in unprecedented detail.

Setschenow constants for prediction of salting-out of petroleum hydrocarbons in brines

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Large scale implementation of carbon capture, utilization, and storage (CCUS), as well as the management of produced water associated with energy production activities (including extraction of natural gas from shale plays) requires a better understanding of the interaction of petroleum hydrocarbons with highly concentrated brines. It is not well known how very high levels of electrolytes influence the solubility of hydrocarbons. The objective of this study is to determine if existing salting-out parameters, called Setschenow constants, are applicable to predict the decrease in aqueous solubility of petroleum hydrocarbons, including polycyclic aromatics hydrocarbons (PAHs), phenols, and thiophenes, due to high levels of electrolytes in concentrated oilfield brines.

We measured the solubility of important organic compounds found in oilfield brines, such as naphthalene. Electrolytes studied include NaCl and CaCl₂, which are the most common salts found in oilfield brines (*1*). The organic compounds in the brines were extracted with a 100 µm polydimethylsiloxane (PDMS) fiber using solid phase microextraction (SPME) and analyzed by an Agilent 6890 gas chromatograph coupled with a flame ionization detector (GC-FID).

We hypothesize that existing Setschenow constants measured at lower ionic strengths (e.g. up to seawater) will also predict the salting-out effect at very high ionic strengths expected in brines (5M) for a range of compound classes of interest. These results are expected to have implications for enhanced oil recovery, CCUS, and any other industry that deals with produced waters. If valid, the solubility of these compounds can be readily modeled using existing Setschenow constants determined at lower ionic strengths.

[1] Kharaka, Y. K.; Hanor, J. S. 5.16 - Deep Fluids in the Continents: I. Sedimentary Basins. In *Treatise on Geochemistry*; Holland, E.-C. H. D.; Turekian, K. K., Eds.; Pergamon: Oxford, 2003; pp 1-48.