

International Conference on **Geology**

June 22-23, 2015 Florida, USA

Volcano-sedimentary characteristics in the Abu Treifiya Basin, Cairo-Suez District, Egypt: Example of dynamics and fluidization over sedimentary and volcanoclastic beds by emplacement of syn-volcanic basaltic rocks

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This study reports on lava-sediment interaction focusing on the Neogene volcano-sedimentary sequence in the Abu Treifiya Basin, Cairo- Suez district, as a detailed example. The dynamic lava-sediment interactions as peperites happen on a variety of scales from simple sediment interbeds with the extrusive and intrusive basaltic rocks and hydrothermal products at a large scale down to complex breccia horizons and bulbous lava-sediment contacts at small scales. They have been identified for the first time at the Abu Treifiya Basin and can only be used as widespread paleoenvironmental indicators with limitations to demonstrate magma and surface water nonexplosive interaction. The study of peperite is important in establishing broad contemporaneity of magmatism and sedimentation along with explosive hydrovolcanic hazards and this finding is significant for the reconstruction of evolution in the study area. The basaltic lava peperites and sedimentary rocks are up to 350 m thick and form a continuous stratigraphic section that is distributed regionally in the study area over a distance of 100 km. Five types of peperites are described and interpreted as resulting from basaltic lava bulldozed into wet, unconsolidated sediments at their basal contacts. Evidence that the sediments were unconsolidated or poorly consolidated and wet when the lava flowed over them, includes vesiculated sediment, sediment in vesicles and fractures in lava flow and in juvenile clasts in the peperite and soft sediment deformation. All peperites in this study could be described as blocky or fluidal on the basis of juvenile clast, but other shapes occur and mixtures of different clast shapes are also found regardless of the host sediment. Blocky and fluidal clasts in the peperite display progressive disintegration, suggesting decreasing temperature and increasing viscosity during fragmentation. Abundance of blocky clasts with respect to fluidal clasts in the peperites indicates that the fluidal emplacement and low-volume sediment fluidization in the early stages were immediately followed by quench fragmentation due to the high viscosity of the magma. Sediment fluidization, formation of vapor films, magma-sediment density contrasts and explosive fragmentation as well as magma properties such as composition, viscosity and vesicularity are the main mechanisms invoked to generate the peperites. Various combinations of these contrasting features to varying degrees may form diverse juvenile clast shapes in peperitic domains. During cooling, the larger fluidal shaped clasts settled to the base of the sequence, through the saturated sediment, producing the vertical evolution during peperite formation and cannot be attributed to remobilization or mass flow. Peperites occur in phreatomagmatic intra-crater/conduit or ventfilling deposits and along contacts between sediment and intrusions, extrusion, and hot volcanoclastic deposits in two environments. Carbonate-lava interactions occur in shallow marine which changes to subaerial fluviolacustrine environment through the mingling between lava flows and siliciclastic sediments during the onset of basaltic volcanism. This work suggests that the Abu Treifiya Basin may be an important local for the study of subvolcanic phreatomagmatic processes and associated phenomena.

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