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Determining the concentration of individual eruptive events of the CAMP: Distinguishing interflow hiatuses from subterranean alteration and void infilling.

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More important than the total volume of eruptives in a LIP is the concentration in time of individual eruptions with timescales relevant for environmental change. In CAMP lavas, interflow sedimentary and reddened levels are interpreted as evidence of significant time between flows of hundreds to thousands of years allowing soil development and sediment deposition. Additionally, cross-cutting or enclosed sediment bodies, and basalt and sediment mixtures are interpreted as clastic intrusions and phreatic mixing (peperites). Here we show that most such occurrences are more consistent with post-emplacement alteration and void infill by sediment.

Criteria for recognizing void fillings in cross-cutting, enclosed or mixed basalt include: 1) paleo-horizontal sediment stratification independent of basalt clasts or void walls – i.e. geopedal; 2) presence of clasts alien to underlying units such as lithic clasts or bones, the latter analogous to karst occurrences; 3) presence of current structures such as ripples; 4) lack of basalt chill margins; and 5) preserved stratigraphy related to overlying units.

Criteria for recognizing flow-contact-parallel sediment bodies and reddened and altered contacts as post-emplacement alteration and void infill include: 1) reddening and alteration of both the upper surface of the older flow AND the lower surface of the overlying flow (caused by post-emplacement ground-water-flow); 2) presence of clasts derived from the bottom of the overlying flow; 3) location of tabular sediment bodies within blisters and paleosurface-parallel crack-sheets of the older flow, rather than at the contact between flows; and 4) physical connection between paleosurface-parallel sediment bodies and sediment bodies that cross-cutting the younger flow exhibiting post-emplacement features described above.

Features that might be indicative of deposition at the land surface but are not include: 1) roots, which can penetrate for tens of meters through sediment-filled cracks in the flow and spread laterally at its base; 3) footprints of small subterranean animals.

Features that could identify a significant temporal hiatus between flows absolutely require being produced at the land surface including: 1) terrestrial animal footprints too big to fit in the void; and 2) features requiring sunlight, such as in situ above-ground parts of plants, a root or possibly soil profiles terminating upward at paleohorizonatal surfaces, and possibly stromatolites.

Using the above critera, most interflow and cross-cutting features in the Moroccan and eastern North America CAMP prove to be post-emplacement subterranean void fillings and alteration phenomena. There is a residuum of hiatuses that correspond to previously recognized geochemical boundaries between flow sequences or paleosecular magnetic directional groups. This weeding out of spurious hiatuses magnifies the concentration of eruptive events by reducing the inferred duration by one or two orders of magnitudes. For example the more than 30 or so individual basalt flows of the Argana and Central High Atlas basins of Morocco can be reduced to perhaps as few as 4 giant eruptions each lasting less than a hundred years or so. It is the magnitude of these events not the total volume that is most relevant CAMP kill mechanisms.