

SLAB CARBONATES IN ALLAN HILLS 84001 AND IN BASALTS FROM SPITSBERGEN, NORWAY: FURTHER EXAMINATION OF TERRESTRIAL ANALOGUES.

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Introduction: Carbonates and other secondary minerals in the martian meteorite Allan Hills (ALH) 84001 provide a record of aqueous activity on Mars, but lack geologic context. By examining terrestrial analogues, we can evaluate environmental conditions that may have existed in early martian history. Elongate “slab” carbonates in ALH 84001 [1] arose during the same generation of carbonate growth as the widely studied rosettes [2]. Carbonates from Spitsbergen, Norway resemble these rosettes [3], suggesting, by analogy, that ALH 84001 carbonates may also have been deposited under hydrothermal conditions. We compare slab carbonates in ALH 84001 to those from Spitsbergen to determine whether growth conditions were similar through the entire history of carbonate deposition.

Methods: Samples of carbonate-bearing basaltic breccias were collected from a vertical conduit on the ~1 Ma Sverrefjell volcano in NW Spitsbergen [4]. Sample SV01-5 (Fig. 1) has been examined by SEM, microprobe and CL.

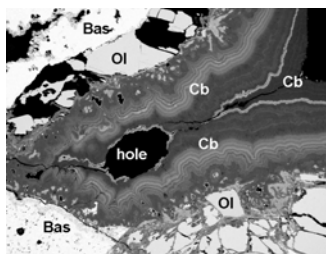


Fig. 1: BSE image of carbonates in SV01-5_2_03. FOV = 2.7 mm.

Results: Texturally, carbonate regions in SV01-5 resemble slab carbonates in ALH 84001 [1]. Compositional zoning occurs on a similar scale (10 μ m) in both, although SV01-5 slab

carbonates are compositionally restricted to the calcite-magnesite join (<~3 mol % FeCO_3) of the carbonate ternary with an outer layer of more Mg-rich carbonate ($\text{Mg}_{95}\text{Ca}_5\text{CO}_3$). While [3] observed a broader range of compositions, including Fe-rich carbonate rosettes and Fe-bearing dolomite, no such diversity is present in SV01-5.

Discussion: While slab carbonates in SV01-5 and ALH 84001 are texturally similar, marked differences in the relationship between carbonate generations in the two rocks differs. Successive layers of ALH 84001 carbonates [1, 5] show systematic variations in composition, consistent with an evolving fluid composition and/or fluids that differed slightly in composition. In contrast, Spitsbergen carbonates investigated here exhibit a compositional hiatus between rosettes and slabs [3], likely reflecting separate hydrothermal depositional events. Though hydrothermal deposition of carbonates at Spitsbergen carbonates has offered the closest analog to date for ALH 84001, compositional differences suggest that hydrothermal alteration affecting ALH 84001 was less extensive and/or episodic than at Spitsbergen.

References: [1] Corrigan C. M. and Harvey R. P. 2004. *MAPS* 39:17–30. [2] Mittlefehldt D. W. 1994. *MAPS* 29:214–221. [3] Treiman A. H. et al. 2002. *EPSL* 204:323–332. [4] Amundsen H. E. F. 2004. Abstract #2119. 35th LPSC. [5] Corrigan C. M. et al. 2004. Abstract #1611. 35th LPSC.