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Implication for the origin of tholeiitic silicic magmas from atmospheric pressure fractional crystallization of basaltic lava flows on Reykjanes peninsula (Iceland), Lanzarote (Canary Islands) and Masaya (Nicaragua).

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Basaltic lava flows frequently contain segregation veins formed by gas-filter pressing of more evolved liquid. Pairs of samples, from host lavas and included segregation veins from the Reykjanes Peninsula (Iceland), Lanzarote (Canary Islands) and the volcano of Masaya (Nicaragua), allow the assessment of a near complete fractional crystallization of olivine tholeiite at a pressure close to one atmosphere. The final products consist of silicic melts, represented by glass patches in the groundmass of the segregation veins. The composition of these melts is "granitic" in the case of Lanzarote and Masaya, but overwhelmingly "trondhjemitic" at Reykjanes. At a pressure of about one atmosphere, fractional crystallization leads to different evolution paths controlled by the Na_2O/K_2O of the initial basaltic liquid, as evidenced by the three lavas coming from different geodynamical context. The liquid line of descent, thus, leads to the granitic minimum if the initial liquid has a low Na_2O/K_2O and to trondhjemitic composition for a high initial liquid Na_2O/K_2O.

When these highly differentiated glasses are compared with analyzed dacites and rhyolites from central Iceland it appears that these silicic magmas can only be produced by high degree of fractional crystallization from basalts having a K_2O/Na_2O significantly higher than those measured on Reykjanes peninsula. Such basalts are known in central Iceland where they are considered as reflecting higher mantle plume influence. However, fractional crystallization is a quite inefficient mechanism to generate large

volumes of silicic magmas, since the final glass patches in the segregation vein result from more than 97% fractional crystallization. On the other hand, the trondhjemitic compositions of the glasses may imply that fractional crystallization of olivine tholeiites could have played a significant role during the formation of the very early continental crust. Indeed in Hadean times, fractional crystallization of olivine tholeiites (large magma ocean?) could have generated the first trondhjemitic continental crust and may be the first continents.