PRECIPITATION OF SECONDARY PHASES FROM THE DISSOLUTION OF SILICATE GLASSES

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Abstract—Basaltic and anorthositic glasses were subjected to aqueous weathering conditions in the laboratory where the variables were pH, temperature, glass composition, solution composition, and time. Leached layers formed at the surfaces of glasses followed by the precipitation of X-ray amorphous iron and titanium oxides in acidic and neutral solutions at 25°C over time. Glass under oxidative hydrothermal treatments at 150°C yielded a three-layered surface; which included an outer smectite layer, a Fe-Ti oxide layer and an innermost thin leached layer. The introduction of Mg into solutions facilitated the formation of phyllosilicates. Aqueous hydrothermal treatment of anorthositic glasses (high Ca, low Ti) at 200°C readily formed smectite, whereas, the basaltic glasses (high Ti) were more resistant to alteration and smectite was not observed. Alkaline hydrothermal treatment at 200°C produced zeolites and smectites; only smectites formed at 200°C in neutral solutions. These mineralogical changes, although observed under controlled conditions, have direct applications in interpreting planetary (e.g., meteorite parent bodies) and terrestrial aqueous alteration processes.