Paleoenvironmental Investigations of Pliocene Intertrappean Paleo soils, Taos Plateau, New Mexico, Suggest Long-Term Semiarid Pedogenesis

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Lava flows on the Taos Plateau preserved paleosols that existed beneath the flows when they were erupted at approximately 4 Ma. These paleosols provide a record of the climate conditions under which they formed. We are investigating two paleosols from within the Servilleta Basalts in northern New Mexico, USA, in an effort to determine the paleoenvironmental conditions present during pedogenesis. Using bulk geochemical composition of paleosol B horizon materials, we performed a geochemical climate analysis (GCA) in order to estimate mean annual precipitation (MAP) during pedogenesis. Our GCA results suggest MAP of up to 1030 mm/yr. However, the presence of a stage III pedogenic carbonate horizon, which typically forms under MAP conditions of 400-600 mm/yr, seems to contradict GCA results. In addition, during thin-section optical microscopy we observe well-developed argillans and possible weakly developed ferrans on many of the grains within paleosol B horizons, further suggesting MAP conditions typically found in arid or semi-arid environments. Within the paleosols we observe quartz and potassium feldspar, neither of which are present in the encapsulating Servilleta Basalts. We interpret these compositions as having resulted from aeolian deposition onto the soil during pedogenesis. The collected samples are from two paleosols that are separated by a two m-thick tholeiitic basalt flow and are similar in both chemical and mineral composition. These similarities suggest that relatively constant paleoenvironmental conditions persisted during the formation of both paleosols. The presence of a stage III pedogenic carbonate horizon in the lower paleosol suggests a pedogenesis duration of ~100,000 years.

Keywords:
Paleosols, Taos Plateau, Paleoclimate

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