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The interplay between the weathering regime of volcanic ash deposits and their chronostratigraphic framework

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The glass fraction in volcanic ejecta is the most readily altered silicate, which makes it a potentially sensitive indicator of climate as long as the alteration environment is identified and the time framework when alteration occurred can be deduced. The most obvious academic use for understanding the factors that control the alteration of volcanic ash is the ability to use it to reconstruct past climates and the weathering environments of the more recent geological past. For example, the Kamchatka Peninsula is a cold region with a rugged topography that contains numerous recent and extinct volcanoes over a large range of altitudes (580–4800 m). Research in the Kamchatka Peninsula started in the early 1960's and for the next 20 years much discussion and uncertainty ensued regarding the nature and the origin of the <5 μm fraction of volcanic ash samples. Gushchenko (1965), who worked on ashes from northern Kamchatka, concluded that volcanic ash samples with halloysite and kaolin clay contents >80% in the <0.01 mm fraction had ages >3000 years. Braitseva et al. (1968) examined ancient volcanic ash deposits in the Central Kamchatka Depression and reported the absence of secondary minerals. Geptner and Ponomareva (1979) conducted thermal studies of the <0.01 and <0.001 mm fractions of volcanic ash and demonstrated that isotropic materials that had most likely formed from volcanic glass were present, but the samples contained no clay minerals. Markin (1980) conducted a thermal study of ash samples collected north of the Kluchevskaya volcano group by using differential thermal analysis method. The radiometric ages of the oldest samples were >8500 years. The thermal analysis curves did not show endothermic characteristics of clay minerals. Many years later (Kuznetsova and Motenko, 2014), infrared spectroscopic studies of volcanic from Northern and Central Kamchatka identified two amorphous phases, opal and allophane, as the products of volcanic glass alteration. Allophane is similar to some layer silicates concerning the chemical composition and structure. Thermal analysis curves did not show the presence of clay minerals. At the present time, the oldest quaternary deposits found in Kamchatka are exposed in the banks of the Kamchatka River in Central Kamchatka. These deposits are referred to by the general term "blue clays" and have Lower Pleistocene age. Mineralogical analyses of a volcanic ash layer collected from the "Krutoy" river bank indicated only opaline silica and no clay minerals (Kuznetsova and Motenko, 2014).

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