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Marker ash layers at Two-Yurts lake, Kamchatka: chronological significance and environmental impact

O. Dirksen (1), T. Danhara (2), and B. Diekmann (3)

(1) Institute of Volcanology and Seismology FED RAS, Petropavlovsk-Kamchatsky, Russia (dirksen@kscnet.ru), (2) Kyoto Fission Track Co. Ltd., Kyoto, Japan, (3) Alfred-Wegener-Institut für Polar- und Meeresforschung (AWI), Potsdam, Germany

Thorough paleoenvironmental investigations require reliable age control which is usually achieved with detail radiocarbon dating of the deposits. In case of Kamchatka peninsula multiple ash fall deposits could also provide rather convenient tool for sediment dating. In the scope of German-Russian research project “KALMAR”, to reconstruct Late Quaternary paleoenvironments and climate changes, we study lacustrine deposits at Dvuhyurtochnoe (Two-Yurts) lake and soil sections around it. At the soil sections we found as much as 27 ash horizons. Based on ash mineral assemblage, glass chemistry composition and radiocarbon dating we identified up to 10 tephras of Shiveluch volcano, the nearest and one of the most active volcano in Kamchatka. Correlation with previously described sections at the foot of the volcano allowed us to determine the ages of these ashes, viz. 900, 1400, 1750, 2800, 4800, 4900 and 8300 14C BP. We also found the ashes of Ksudach and Khangar volcanoes with ages of 1800 and 6900 14C BP, correspondingly. These ashes at on-land sections form chronological basement which we used for lake sediments investigation. Lake sediment cores revealed less favourable conditions for ash preservation. Most of the ashes form discontinues lenses, patches and small spots. But their mineralogical and chemical characteristics allowed most of them to be correlated with ashes at soil sections and obtain detail stratigraphical basement for paleoenvironmental investigations. Besides, tephra study has additional significance for paleoclimate reconstructions. Each ash deposition could affect the lake environment due to large amount of water-soluble compounds adhered to ash particles. Using the ash leachates of tephra of Bezymianny volcano eruption 1956 AD as a reference and considering the thicknesses of deposited Shiveluch ashes we calculated that every ash fall could add to the lake water as much as 0,05-0,1 tons of Cl-, 0,17-0,5 tons of SO4-, 0,035-0,105 tons of HCO3-, 0,060-0,180 tons of Ca2+, etc. The changes of water chemistry could create more fertile conditions or, opposite, depress a lake biota. These short-term but probably rather pronounced changes should be considered during the paleoenvironmental reconstructions to avoid mistaken attribution them to abrupt climate changes.