Holocene Volcanic Ash Fall: A Reconstruction and Evaluation of Interbasin Spatial Variability

Kasey Kathan and Al Werner
Mount Holyoke College, South Hadley, MA

Located just north-east of the Aleutian Arc, one of the most volcanic regions of North America, lies Anchorage, Alaska. Approximately 60% of Alaska's population resides within this city, which serves as a major international trade port. This location in combination with the prevailing high altitude southwesterly winds, places Anchorage directly in the path of volcanic ash fallout originating from the Aleutian Island Arc. Volcanic ash, and the associated sulfuric gases, pose a major threat for the city in terms of limiting transportation (jet engine failure), blanketing the ground surface, and minor associated health risks (Casadevall 1994). Previous work in the region has identified approximately 8 major ash fall events through the past century (Begét et al., 1994) and at least 16 eruptions within the past 12,000 yr BP (Hancock, 2002). This project attempts to evaluate the volcanic ash fall record within a small kettle lake basin north west of Anchorage, and to document interbasin variability of individual ash units.

Six lacustrine cores were recovered from Lorraine Lake, a small kettle lake basin lying on the late glacial Elmendorf moraine located on the north side of Knik Arm. Lorraine Lake is located approximately 7 miles northwest of the city of Anchorage, is closed, has a limited drainage basin and consists of two basins (north and south ends) separated by a shallow (5 ft.) bench. Cores were taken in the north, south, east, and west extents in an effort to evaluate how ash fall deposition changes spatially within the basin. The southern core ended in a basal unit containing striated stones (glacial diamicton), indicating that the record is complete through the postglacial period, which dated at approximately 12,310 C^{14} yr. 11 prominent ash fall events have been confidently correlated based on visual core stratigraphy, and magnetic susceptibility. Vesicular bubble walled volcanic ash grains (containing titano-magnetite inclusions) are present in these units. It is this association with magnetite that causes the increased magnetic susceptibility response over ash units. Ash units are further indicated by an increase in bulk magnetic weight percent and a decrease in organic matter content. Stratigraphic thickness, area under the magnetic susceptibility curve, and an ash unit classification scheme (based on visibility, thickness, and contact type) has been used to evaluate interbasin variations. While there are apparent local differences in sedimentation rates throughout the basin, the ash unit deposition and preservation does not appear to be affected, nor does it appear to vary spatially in a regularly predictable manner.

This work suggests that despite probable depositional complexities (eg. wind shear, waves, lake ice, blowing snow etc.) there is a surprising similarity of volcanic ash units throughout the basin. Based on these data, it does not appear to matter specifically where a lake is cored, although cores from "near-shore" locations appear to have more macroscopic organic matter suitable for radiocarbon dating.