Holocene Volcanism and its Effect on Human Occupation in the Susitna River Valley, Alaska

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Abstract
Archaeological and stratigraphic evidence from the Susitna River Valley, Alaska, reveals a rich record of human occupation, as well as evidence of the impacts of Holocene volcanic events. This study uses tephrochronological and radiocarbon methods to establish a refined chronology of volcanic events and human occupation in the Susitna, Oshetna, and Devil tephra units. A chronological framework for the Middle Susitna River Valley was established using radiocarbon dates in association with stratigraphic units. Geochemical characterization and radiocarbon dating will allow for more precise age determinations and correlation to the Hayes tephra set.

Archaeological Work in the Susitna River Valley

- Archaeological work during the 1980s for the Susitna Hydroelectric Project aimed to locate and evaluate cultural material in the Susitna River Valley, and resulted in the identification of 258 archaeological sites (Dixon et al. 1985).
- Stratigraphy was documented throughout the project and 16 depositional units, consisting of lithologic units, contact units, and stratigraphic horizons, were identified. A chronological framework for the Middle Susitna River Valley was established using radiocarbon dates in association with stratigraphic units.
- Multiple tephra units were present at many of the sites excavated, which also exhibited evidence of multiple instances of human occupation. The tephra units were informally named, from oldest to youngest, the Oshetna, Watana, and Devil tephras.
- Analyses of the tephra present in the Susitna River Valley, focused on the mineralogy, petrography, and glass shard morphology of the tephra units to establish inter-site and intra-site correlations and variations (Dilley 1988; Dixon et al. 1985; Romick and Thorton 1985). The mineralogy of the three tephra units present in the Susitna River Valley was found to be very similar, suggesting a similar source (Dixon et al. 1985).

The Susitna River Valley

- The Susitna or ‘Sandy’ River is located in South-central Alaska and flows 553 km from the Susitna Glacier, in the Alaska Range, to the Cook Inlet, near Anchorage, Alaska, and is part of the Susitna drainage (Glaister 2005). The river flows 503 km from the Susitna Glacier, in the Alaska Range, to the Cook Inlet, near Anchorage, Alaska.
- There have been multiple volcanic events in the Susitna River Valley, i.e. do the Devil, Watana and Oshetna tephra units each represent one volcanic event or are they composites of more than one tephra deposit?
- How many volcanic events are represented in the stratigraphic record of the Susitna River Valley, i.e. do the Devil, Watana and Oshetna tephra units each represent one volcanic event or are they composites of more than one tephra deposit?
- The archaeological record does not offer a resolution high enough to demonstrate the impact of volcanic eruptions on prehistoric populations. However, using radiocarbon dates, it is possible to interrelate the tephrochronological evidence and previous archaeology in the Susitna River Valley. This will allow the archaeologist to consider the influence of volcanic events on human occupation.

Methods
- Wet sieve tephra samples from archaeological sites and cores, separating deposits of seven or less, were radiocarbon dated to between 3500 and 3800 years B.P. Some of these dates are not accurate, whereas others may be incorporated into the analysis. Additional dates may also be obtained from samples within the museum collections that have not been analyzed yet.

Radiocarbon Samples
- Approximately 60 radiocarbon dates, from archaeological contexts and associated with tephras, were collected during the archaeological work in the 1980s. Some of these dates are not accurate, whereas others may be incorporated into the analysis. Additional dates may also be obtained from samples within the museum collections that have not been analyzed yet.

Hayes Tephrochronology
- Riehle et al. (1990) established the geochemistry of tephra deposits in the Cook Inlet region derived from the Hayes volcano, a vent in the Tordrillo Mountains. The ‘Hayes tephra set’ was designated, consisting of deposits from seven or eight eruptions, constrained by 18 radiocarbon dates to between 3500 and 3800 years B.P.
- Bottile and a high ratio of amphibole to pyroxene phenocrysts are unique mineralogical characteristics of the Hayes tephra, which are also present in the Devil tephra.
- Dilley (1988) and Riehle (1990) suggest that the Watana and Devil tephra units originated from the Hayes vent, and that the discrepancy in radiocarbon dates originated due to contamination from Tertiary coal, making the ages appear too old, or downward leading of humics, making the ages appear too young.

References Cited


Hayes tephra set radiocap map reproduced from Riehle et al. (1990).

Correlation of the terrestrial Oshetna, Watana, and Devil tephras with lacustrine and bog cores, reproduced from Dilley (1988).