Geophysical Research Abstracts, Vol. 7, 10766, 2005
SRef-ID: 1607-7962/gra/EGU05-A-10766

Tephra Layers in lake sediments from South and West Iceland

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The climate in Iceland is sensitive to subtle changes in the North Atlantic circulation because of its position at the boundary between the cold East Greenland and warm Irminger currents. This factor along with high sediment accumulation rates (up to 5m/1000yrs) makes marine and lake sediments in Iceland ideal for addressing questions concerning the timing and magnitude of climatic events during the Holocene. Accurate high-resolution age dating of the sediments underpins stratigraphic correlations and is essential for obtaining reliable results.

Explosive basalt to rhyolite volcanism in Iceland has produced numerous widespread tephra fall deposits that often are important marker horizons in Holocene sedimentary sequences. Such widespread tephra fall deposits of known age, in conjunction with high precision AMS ^{14}C dating, are the foundation for constructing unambiguous high resolution regional chronology across marine and land based sedimentary environments.

The principal objectives of our tephra studies are to:

1. construct the tephrochronology for West Iceland over the last 12000 yrs BP using Icelandic lake and marine sediment cores in conjunction with land based soil sections,
2. determine the age of previously unidentified tephra layers of regional dispersal using the ^{14}C method,
3. correlate the tephra layers between sites to establish regional markers extending from lacustrine and marine environments

4. develop an accurate age model for each core and compare ^{14}C ages of tephra layers in the cores, to existing ^{14}C ages of the same layers in soil profiles.

5. quantify the decrease in regional tephra markers with distance from the active volcanic zones. Our sites are oriented roughly perpendicular to the volcanic zones.

6. measure and describe each tephra layer to determine the source volcano and the eruption style for each layer.

Our pilot cores from lake Hestvatn (HST) an lake Hvitarvatn (HVT), which are closest to the active volcanic zones and as expected contain the highest number of tephra layers. HST contains 161 tephra layers and visual inspections indicate that 143 are basaltic, 9 are andesitic and 9 are rhyolitic (yellow or white). Analysis of the lowest rhyolitic tephra layer shows it to be the 11,980 cal yr BP Vedde ash. Total of 129 layers are preserved in the HVT core, of which 92 are basaltic, 34 are andesitic, and 3 are rhyolitic. All of the rhyolite layers are from the Hekla volcano, including the infamous H4 ($\sim$4200 cal yr) and H5 ($\sim$6600 cal yr) tephra fall deposits. In the bottom of the core there are three decimeter thick basaltic layers of an age corresponding to the 10,180 cal yr BP Saksunarvatn tephra (Johannsdottir et al., this meeting).

The lake cores in Northwest Iceland preserve markedly lower number of tephra layers when compared to the pilot cores. The core from Haukadalsvatn (HAK), which is closest to Hvitarvatn, contains 38 layers (25 of basaltic, 12 andesitic and 1 rhyolitic composition) and as we move farther to the northwest the number drops dramatically, first to 7-9 layers in Torfadalsvatn (TORF) and Vatnsdalsvatn VDV) and then to 2-4 layers Efstadalsvatn (EDV) and Laugabolsvatn (LBG). This reduction in the number of preserved tephra layers reflects increasing distance from the source volcanoes within the Eastern Volcanic Zone. Nevertheless, we have identified a few layers that appear to be chronostratigraphic markers of regional significance. These are the Vedde ash, the Saksunarvatn tephra, a $\sim$9500cal yr BP mildly alkaline basaltic tephra layer and $\sim$6000 cal yr BP andesite tephra from Hekla. In the VDV core we also found the rhyolitic component of the Settlement Layer formed in $\sim$870 AD.

Our results show that the Vestfirdir peninsula in northwest Iceland have rarely been affected by tephra fall from explosive eruptions in Iceland. The likely reasons for sparse presence of tephra layers are that the source volcanoes are all within the Eastern volcanic zone, thus as far away from them as possible, and the region has been outside of the main tephra dispersal sectors from these volcanoes. So far we have identified seven tephra layers in lake sediment cores spanning the Holocene. Of the seven, four layers are likely to be of regional significance. These are the 11,980 cal yr Vedde

ash, the 10,180 cal yr Saksunarvatn tephra, the ∼9500cal yr BP tb-basaltic tephra and ∼6000 cal yr BP Hekla andesite tephra . The usefulness of the Settlement Layer as a regional marker is likely to be limited because of its narrow dispersal. Although, additional tephra layers are likely be found by further studies in the northwest, it is doubtful that we will ever obtain the high-resolution tephro-chronstratigraphic record available to us elsewhere in Iceland.