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Climate of the Past Discussions

Interactive comment on "The 3.6 ka Aniakchak tephra in the Arctic Ocean: a constraint on the Holocene radiocarbon reservoir age in the Chukchi Sea" *by* Christof Pearce et al.

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General comments

For the interpretation of any geological records in terms of paleoenvironmental changes versus time, an accurate stratigraphical/chronological framework is necessary. In this context, the most important standard approach for dating Holocene sediments is AMS14C dating of marine and/or terrestrial biogenic/organic material (i.e., foraminifers, molluscs, gastropodes, plant material, specific biomarkers etc.). If using the AMS14C approach, radiocarbon reservoir correction hast o be done. To get the right reservoir age, however, is a challenge, especially in the Arctic Ocean, as it changed on spatial and temporal scales.

The authors have identified and characterized a specific ash layer in their AMS14C-dated sediment core from the Chukchi Sea having a clearly defined absolute age of 3.6 ka. This gives the unique possibility (1) to determine the reservoir age more precisely and - by this - (2) to calculate the AMS14C ages of Holocene sediment cores from the Chukchi Sea much more precisely. Furthermore, the identification of this ash gives the unique chance to accurately correlate marine sediment cores, terrestrial archives as well as ice cores (e.g., the Aniakchak ash layer has been found in the GRIP & NGRIP ice cores) and to identify leads and lags of specific climate signals. The latter is of overall importance for understanding the processes controlling climate change. Thus, this paper is certainly of importance for the scientific community interested in the Arctic and global climate system and its changes through time.

Specific comments

This approach (i.e., the use of volcanic absolute age markers) has been used for the first time in the Chukchi Sea/western Arctic Ocean, correct, but has earlier been used in the Nordic Seas & Fram Strait area (e.g., the use of the Vedde Ash).

It might be useful to add in the map of Figure 1 the general atmospheric circulation pattern showing the pathway of dust/volcanic ash.

The ash layers CFE I and CFE II discussed by Pearce et al. might also be identified in the sediment cores used by Stein et al. (2016) (see attached figure).

Are the ash layers visible in XRF scanning records?

Reference: Stein et al., 2016. Holocene variability in sea ice cover, primary production, and Pacific-Water inflow and climate change in the Chukchi and East Siberian Seas (Arctic Ocean) Journ. Quat. Sci., ISSN 0267-8179, DOI: 10.1002/jqs.2929.

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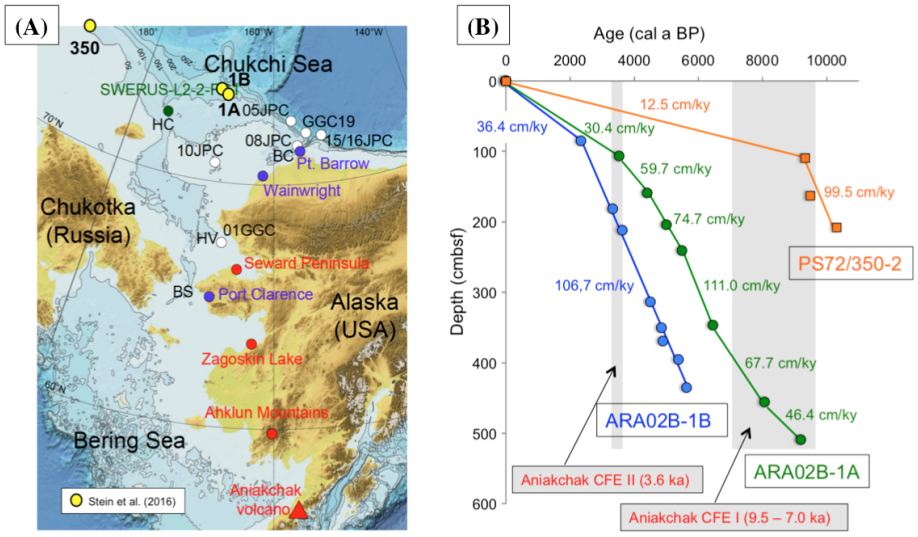

Fig. 1 (Comments R. Stein)
(A) Map from Pearce et al., supplemented by locations of cores studied by Stein et al. (2016);
(B) Age-depth diagram of cores ARA2B-1A, ARA2B-1B, and PS72/350-2 with sedimentation rates (from Stein et al., 2016), gray bars indicate ages of Aniakchak ash layers (taken from Pearce et al., 2016)

Fig. 1. Locations and age-depth diagrams of sediment cores from the Chukchi and East Siberian seas (Stein et al., 2016)