Sedimentary and pore water geochemistry linked to deglaciation and postglacial development of Lake Vättern, Sweden

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Background

Lake Vättern, (Fig. 1a) traversed by ice recession lines with ages from 13 to11.3 cal yr BP (Fig. 1b), constitutes a keypoint for deglacial studies in southern Sweden. In 2012, a unique 74 m sedimentary core (VAT12) wasrecovered in southern Lake Vättern (Fig. 1b). The major lithostratigraphic units of the sediment sequence were tentatively connected to the widely recognized Baltic Sea development stages (Fig. 2) formed by the interplay between the water masses from the melting Fennoscandian Ice Sheet and subsequent isostatic rebound (Swärd et al. 2016). In this study we present the a new chronology for VAT12 along with geochemical, mineralogical and pore water response to the deglacial and postglacial paleoenvironment of Lake Vättern.

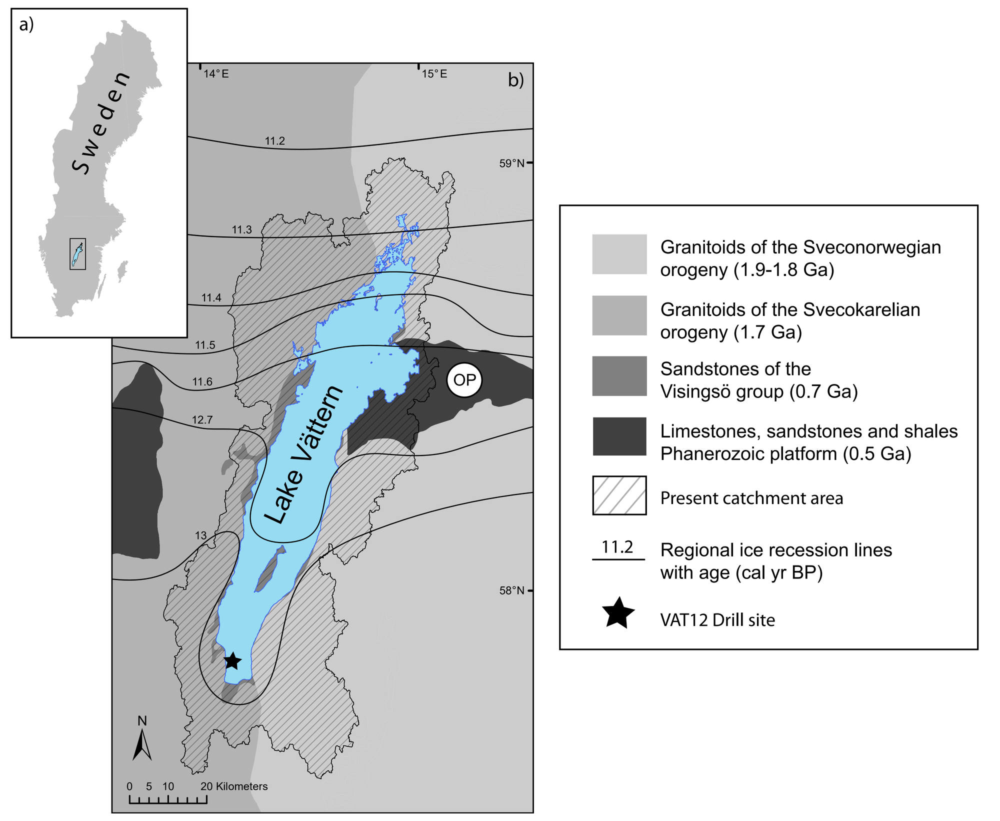

Fig. 1 a) Lake Vättern, southern central Sweden. b) Local bedrock, catchment area and ice recession lines in and around the Vättern basin (SGU Bedrock Sweden; County Administrative Board of Jönköping; Greenwood et al. 2015; Stroeven et al. 2016)

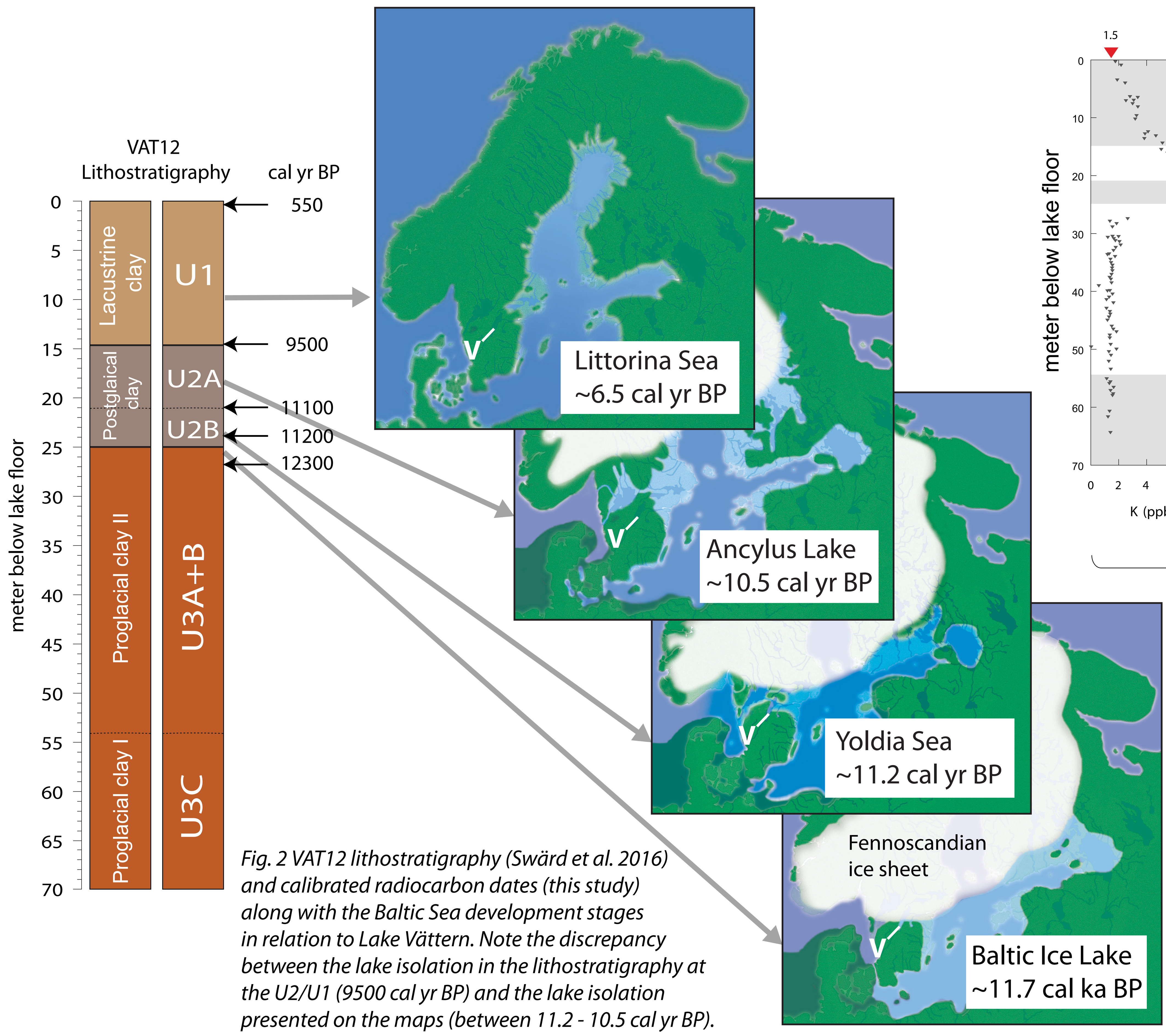

Fig. 2 VAT12 lithostratigraphy (Swärd et al. 2016) and calibrated radiocarbon dates (this study) along with the Baltic Sea development stages in relation to Lake Vättern. Note the discrepancy between the lake isolation in the lithostratigraphy at the U2/U1 (9500 cal yr BP) and the lake isolation presented on the maps (between 11.2 - 10.5 cal yr BP). V= Lake Vättern. Maps are modified from Andrén, 2003

Results

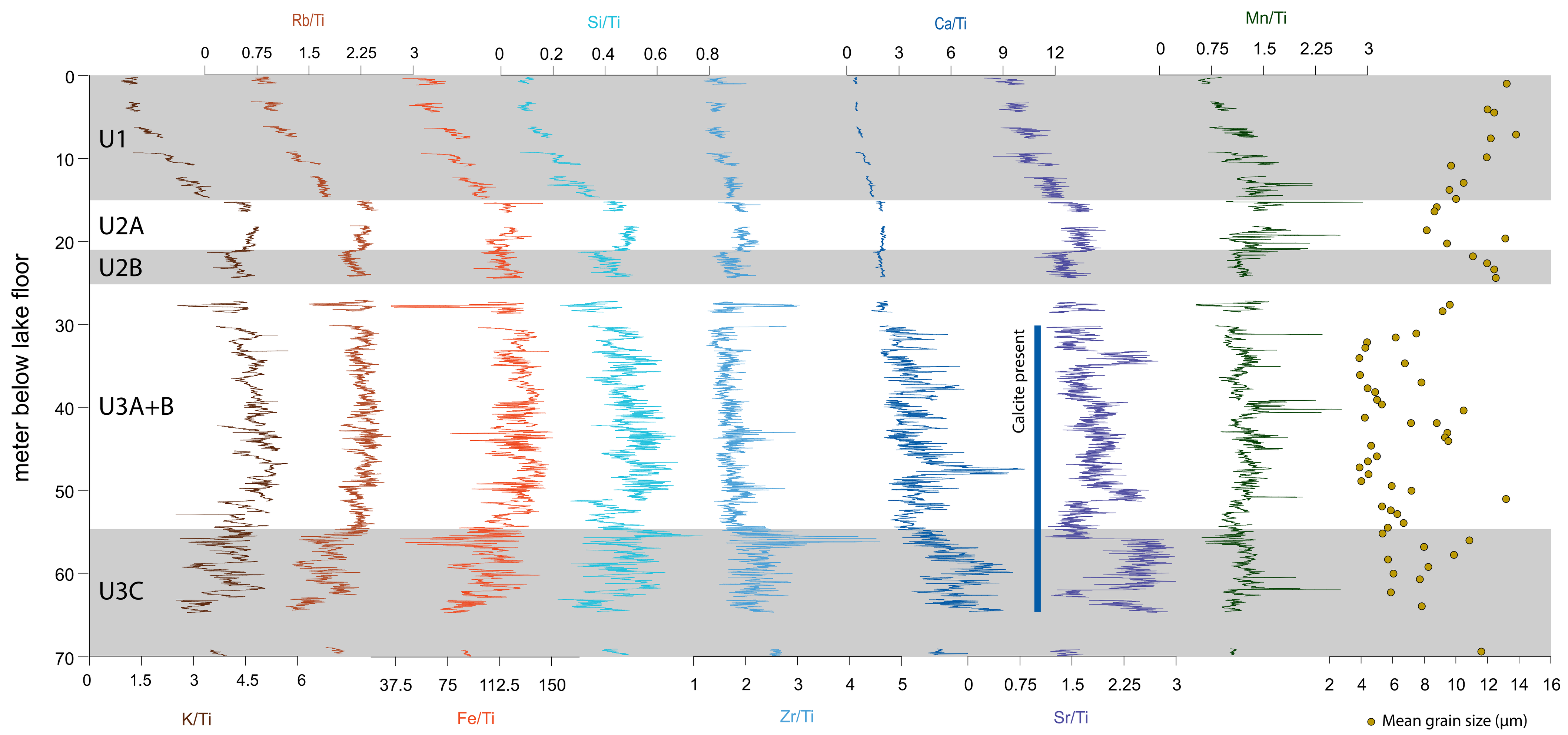

Fig. 3 Ti normalized elemental downhole plots, mean grain size and calcite presence on top of lithological units.

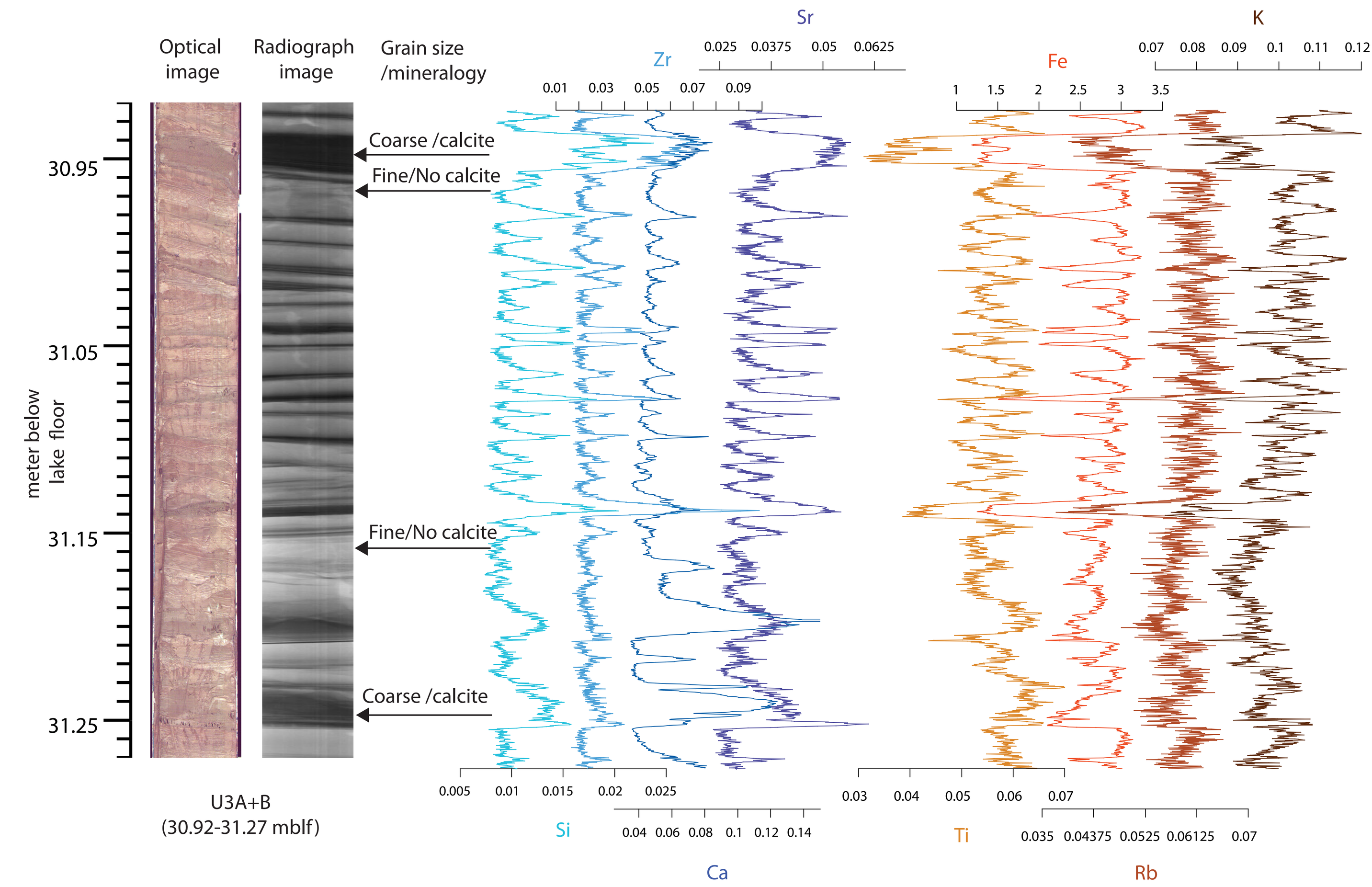

Fig. 4 Elemental data of varved proglacial clay from U3A+B along with grain size and mineralogy of individual laminae .

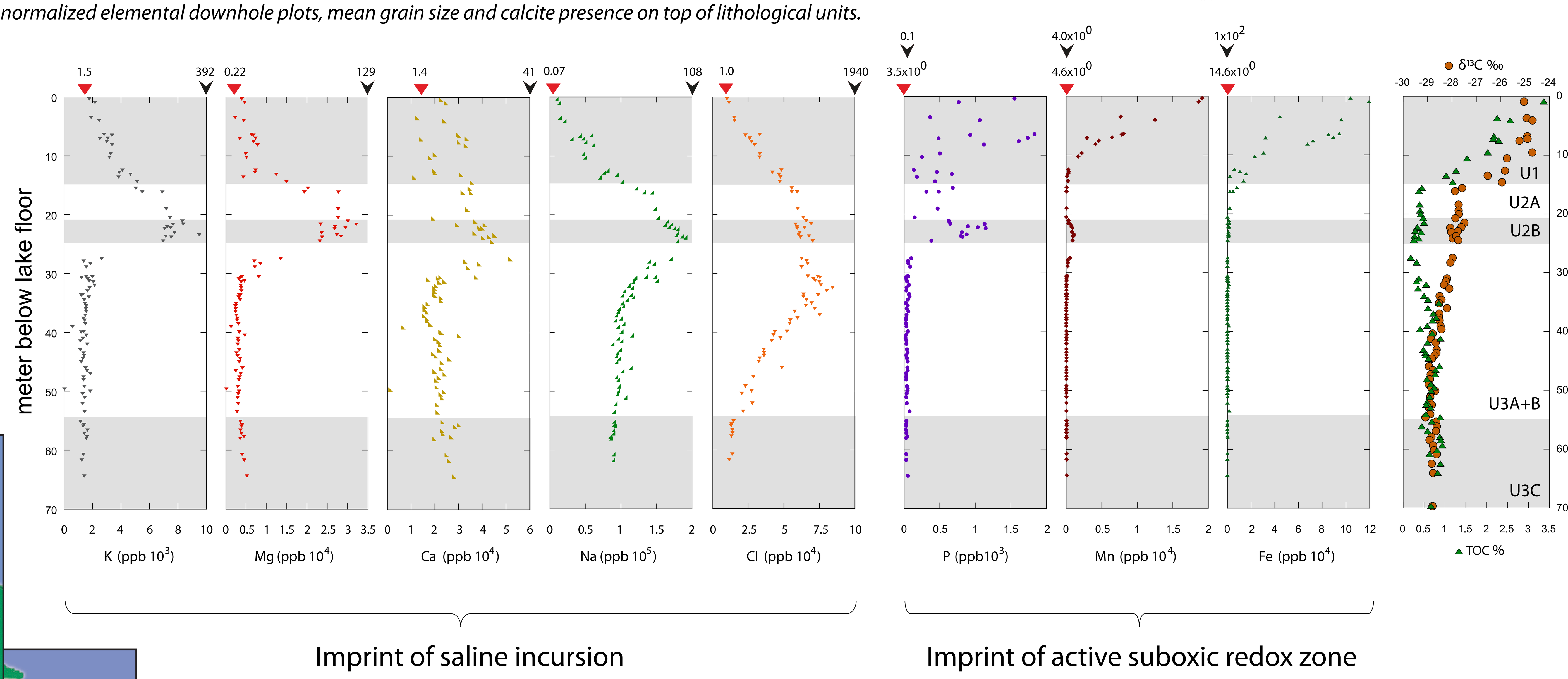

Fig. 5 Pore water chemistry and TOC/δ13C. Red and black triangles above pore water plots indicate concentrations of Lake Vättern bottomwater and North Atlantic surface water respectively.

References

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Conclusions

A. Radiocarbon dates confirm the connection between the Vättern basin and the Baltic Ice Lake/Yoldia Sea and place the lake isolation during the Ancylus Lake stage (10.7-8.5 cal yr BP).

B. Elemental data show little or no difference between the lithostratigraphic units. Variations in elemental data are related to grain size variation as shown in the varved sequence.

C. Calcite/Ca is only detectable in the proglacial clay and are attributed to a local ice derived input from the Ostrogothian plane (OP; Fig. 1b)

D. A saline phase is shown in all major sea water ions in the postglacial clays and attributed to influx of marine waters during the Yoldia Sea stage.

E. The increasing TOC and δ13C along with increase in redox activity shown by increased levels of Fe, Mn and P reveal a general increased in-lake production since the lake isolation.