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CryptoTEPHras in the ICDP Dead Sea deep core to synchronise past eastern MEditerranean hydroclimate (TEPH-ME)

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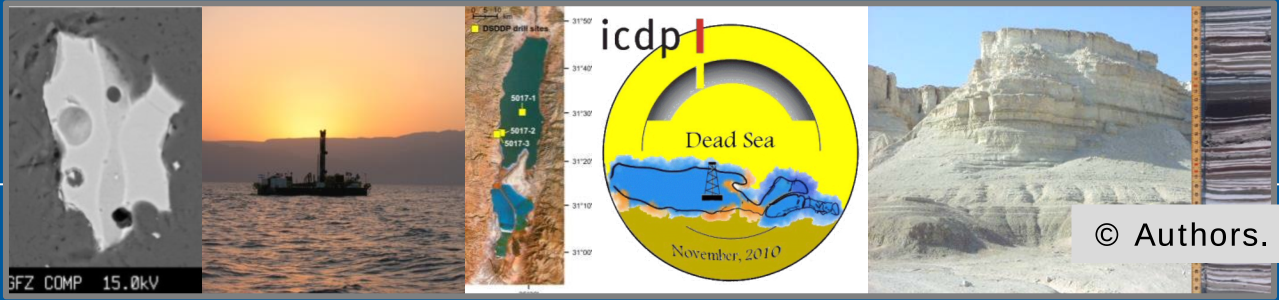

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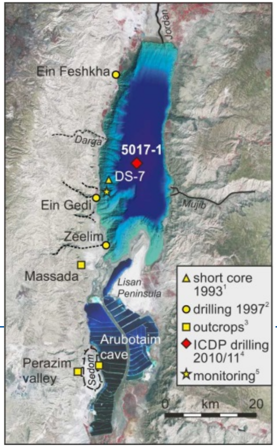
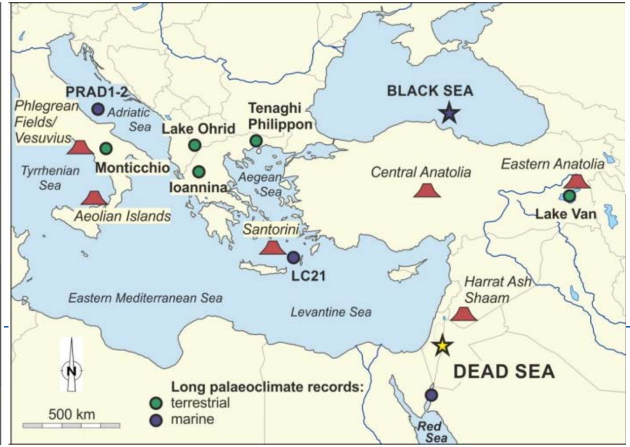
Motivation for the TEPH-ME project

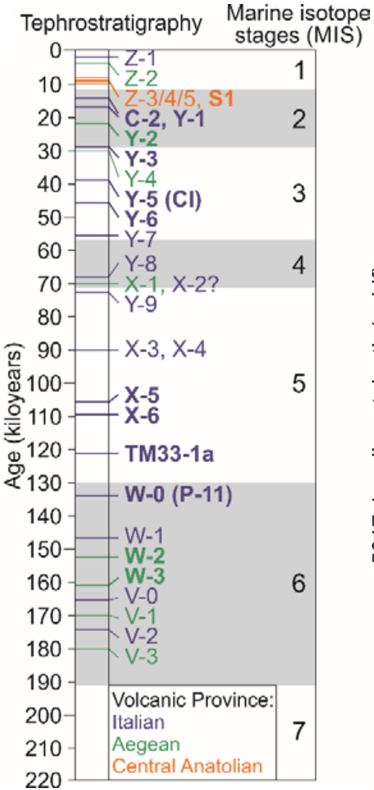
The ca. 450 m long ICDP core 5017-1 from the deep Dead Sea basin spans the last ~220 kyrs, but its age model is poorly constrained. After the first cryptotephra – the early Holocene 'S1' tephra from Central Anatolia – was found *(Neugebauer et al. 2017, JQSR)*, a systematic search for Mediterranean tephra time-markers in the ICDP Dead Sea core has been started.

The TEPH-ME project will allow to:

- Improve the age model of the ICDP Dead Sea core;
- Synchronise the Dead Sea with other palaeoclimate records;
- Advance the well-established Mediterranean tephrostratigraphy to the East including Central and Eastern Anatolian volcanic provinces.







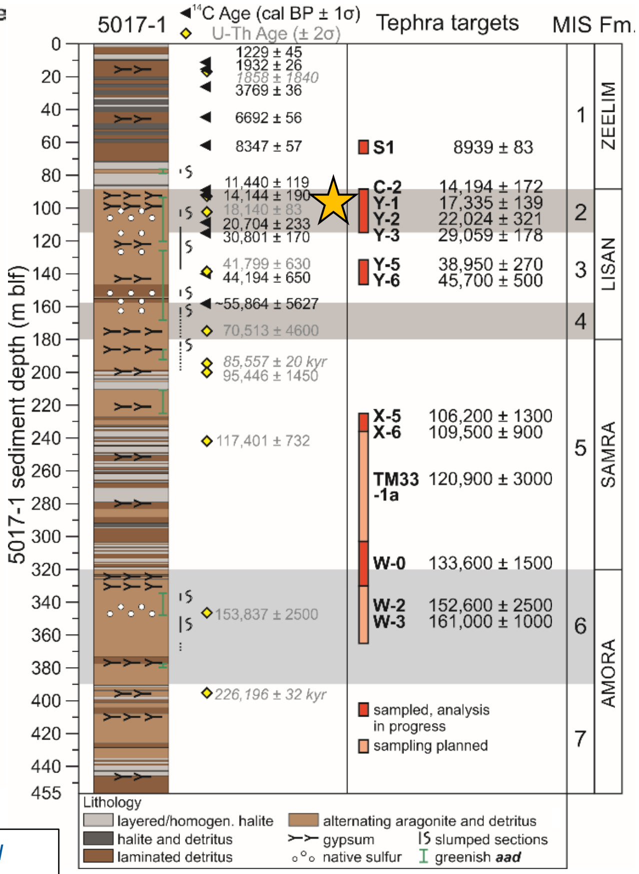


***Fig. 1 (left):** Maps of the Dead Sea and the Eastern Med. with volcanic provinces.*
***Fig. 2 (up):** Mediterranean tephrostrat. and Dead Sea 5017-1 lithostrat. of the last ~220 kyrs.*

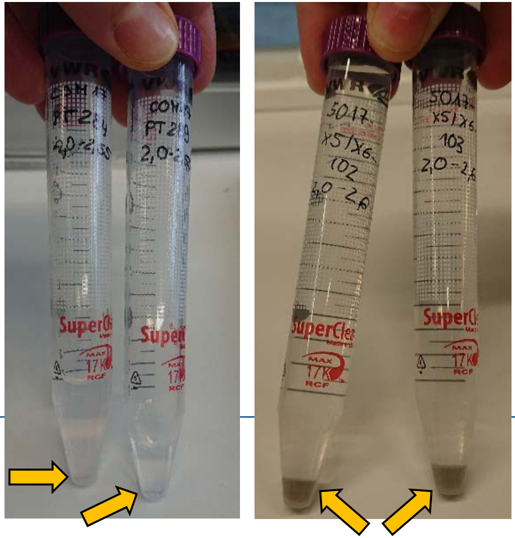
Neugebauer et al. 2014, JQSR

Challenges of cryptotephra search in the Dead Sea record

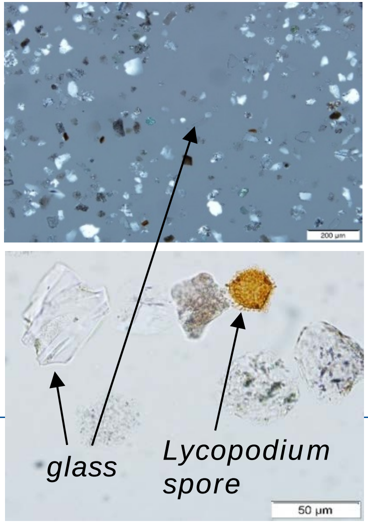
Extremely laborious, adapted tephra extraction protocol:

- 5 cm³ contiguous sampling, *band saw for rock salt*
- *Rinse to remove saline pore water/salt*
- Remove carbonates and organic matter
- Wet-sieving (20-100 µm fraction)
- Liquid density separation (2-2.55 g/cm³)
- *Adding Lycopodium spore tablets (like for pollen counting)*
- Preparing slides and counting (ca 10% of total sample)
- Hand-picking and embedding in resin for EPMA (JEOL JXA-8230)

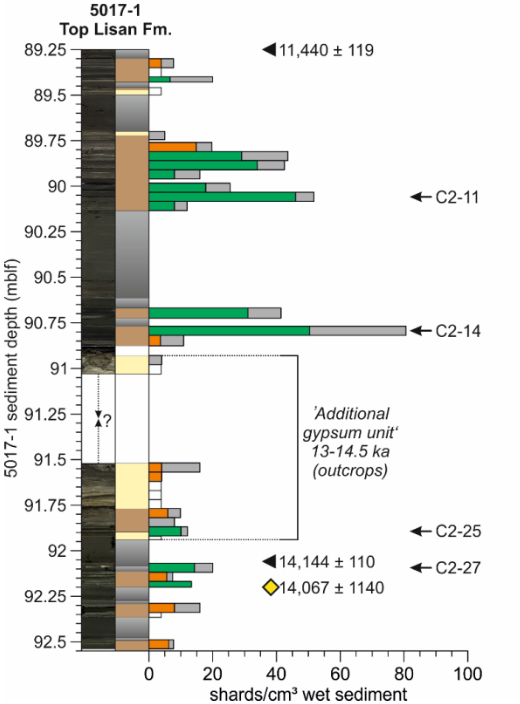
Normal sample vs. Dead Sea after density separation



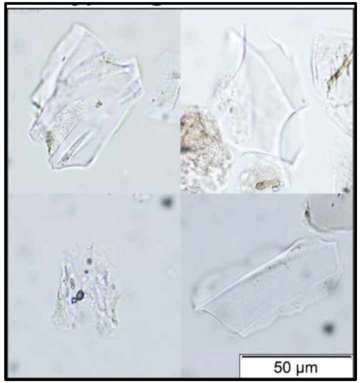
Typical slide



Reworking and alteration of glass shards:



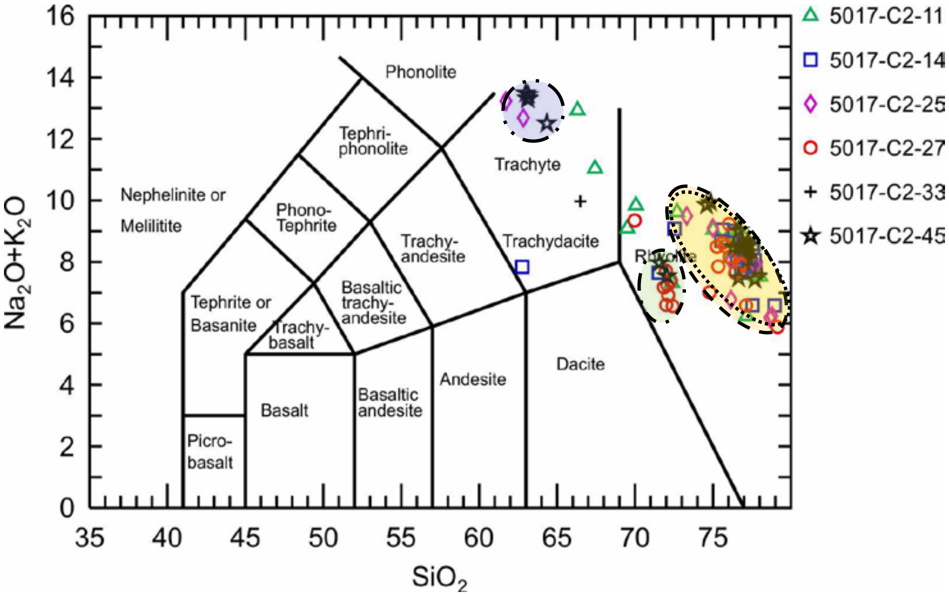
Recycling of sediments



Shards are often physically (rounded) and/or chemically (pitting corrosion) altered.

Fig. 3 (left): *Extremely large amount of mineral grains left after separation requires adapted protocol.*
Fig. 4 (up): *Sediment recycling leads to physical alteration of shards; Dead Sea brine chemically alters shards.*

Preliminary results of lateglacial tephra record and conclusions



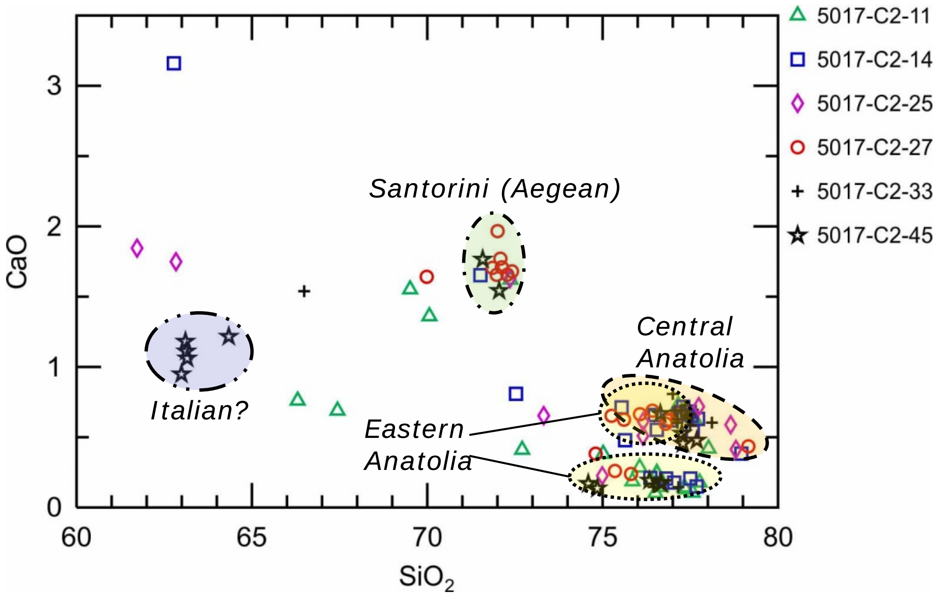


Fig. 3 (up-left): *Total alkali-silica (TAS) diagram of tephra in lateglacial Dead Sea sediments (~15-11 ka).* ***Fig. 4 (up-right):*** *CaO-SiO_2 diagram of the same samples.*

Lateglacial tephra record ~15-11 ka in the Dead Sea:

- Heterogeneous sample populations, but some clusters;
- Mostly rhyolitic tephra (Anatolia!), few trachytic glasses;
- Aegean Province: *Santorini* Y2 tephra (~22 ka) or PhT1 (13.9-10.5 ka); chemically identical major element composition;
- Eastern Anatolia: *Süphan* swarm eruptions (~13 ka) and very likely *Nemrut Dagi* (both volcanoes located at Lake Van);
- Tephras from Central Anatolia and Italy are likely, but no specific volcanoes/eruptions identified yet.

Conclusions:

- Abundant cryptotephra in the Dead Sea record;
- Majority of tephra from Central and Eastern Anatolia, where tephra database is still limited;
- First results are very promising for achieving all objectives of the TEPH-ME project.