Interactive comment on “Is there evidence for a 4.2 ka BP event in the northern North Atlantic region?” by Raymond Bradley and Jostein Bakke

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Karl Popper, Imre Lakatos, and the 4.2 ka BP event in the northern North Atlantic, Anatolia and the Indus

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What do we learn from Bradley and Bakke (2019)?

Bradley and Bakke (2019) state, “A review of paleoceanographic and terrestrial paleoclimatic data from around the northern North Atlantic reveals no compelling evidence for a significant climatic anomaly at ~4.2ka B.P.”, based upon their evaluation of their
sample of northern North Atlantic proxies publications. They did not, however, consider about 50 available and relevant high resolution proxies, most of which document abrupt 4.2 ka BP events in Svalbard, Norway, Sweden, Denmark, Faroe Islands, Iceland, Greenland, and Ellesmere Island, and their proposed article, therefore, “does not approach the consensual standards for science publication” (Weiss 2019). Ön et al. (2019) proclaim jejunely that good science includes all data, that which supports and that which falsifies a theory, and remind us that Karl Popper (1962) claimed falsifiability as the test of scientific verisimilitude and veracity – though Kuhn (1962: 77) had advised, “No process yet disclosed by the historical study of scientific development at all resembles the methodological stereotype of falsification by direct comparison with nature.” Similarly, Imre Lakatos (1978) famously revisited Popper’s claim with his “Methodology of Scientific Research Programmes,” pointing out that Popper’s criterion is too restrictive and would invalidate much of everyday scientific practice. Popper’s falsification demarcation has since been challenged and dismissed repeatedly (e.g., Hansson, 2006).

Skewed and truncated sampling meets the science standards of neither Popper nor Lakatos. Bradley and Bakke (2019) show it is easy to falsify a scientific claim by ignoring all the positive evidence. Surely, a meta-analytic study is one desideratum for further 4.2 ka BP event study but, of course, the selection criteria remain labile.

What do we learn from Lake Hazar, Anatolia?

The northern North Atlantic region is a small, but intensively studied, part of the Eurasian climate systems that are driven by the westerlies, the Indian Monsoon and the East Asian Monsoon. Ön et al (2018) believe that their Hazar Lake, Turkey sediment core disproves the 4.2-3.9 ka BP megadrought observations recorded globally, including in west Asia and its Anatolian plateau (Turkey). That is, Ön et al., (2018) believe they have provided the Anatolian Popperian falsifiability test for 4.2-3.9 ka BP megadrought across west Asia. Fig. 1 lists the twelve Anatolian paleoclimate proxies for the 4.2 ka BP event. Two of the twelve proxy analyses report wet conditions at 4.2
ka BP. Sofular Cave (Göktürk et al., 2011) is, however, not a proxy for the Mediterranean westerlies; it represents the unique situation of the Black Sea and its intrusive, micro-region, northern precipitation. The only westerlies proxy analysis publication for Anatolia that presents a wet 4.2 ka BP period is the Ön et al (2018) Hazar Lake study that statistically analyses XRF data. The Hazar Lake sediment core, however, (a) has a sampling resolution of 175 years, (b) is constrained by two calibrated radiocarbon dates separated by four to five thousand years, and (c) is misrepresented by Ön et al., (2018). The $\delta^{13}$C and $\delta^{18}$O values at Lake Hazar record the 4.2 ka BP abrupt megadrought event (Fig. 2) – despite their study’s poor resolution. In central Anatolia, the 4.2 ka BP event is recorded at Nar Gölü with 5 year sampling resolution (Dean et al., 2015), correcting the earlier Roberts et al. (2001) publication. The Anatolian 4.2 ka BP event data listed in Fig. 1 are sandwiched between the westerlies’ 4.2 ka BP event proxies at the Mavri Trypa coastal Peloponnesian Greece speleothem, sampling resolution 5 years (Finné et al., 2017), the Beirut speleothem at Jeita Cave, sampling resolution 7 years (Cheng et al., 2015), and the Iranian plateau Gol-e Zard speleothem, sampling resolution 2-15 years (Carolin et al., 2019).

What have we already learned about the Mawmluh Cave speleothems and the Indian Summer Monsoon?

Ön et al. (2019) similarly claim that the very high resolution Mawmluh Cave speleothems’ 4.2 ka BP events (Berkelhammer et al 2013; Kathayat et al 2018) need be subject to falsifiability testing. That testing has already been done. The Mawmluh Cave speleothem proxies are the product not of the westerlies, but the Indian Summer Monsoon. The six published ISM proxy studies providing high resolution 4.2 ka BP megadrought events are Staubwasser et al., 2003, Dixit et al., 2014; Nakamura et al., 2016, Dixit et al., 2018; Giosan et al., 2018; and Giesche et al., 2019. The westerlies and the ISM were synchronously and abruptly diminished, displaced, and/or diverted at 4.2 ka BP. So, too, of course, were the East Asian, Indonesian-Australian, African, North American and South American monsoonal systems, extending even to
Antarctica (Weiss 2016).

References


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Ön, Z. B., Akçer-Ön, S., Özeren, M. S., Eriş, K. K., Greaves, A. M., and Çağatay, M.
N.: Climate proxies for the last 17.3 ka from Lake Hazar (Eastern Anatolia), extracted by independent component analysis of $\mu$-XRF data, Quatern Int, 486, 17-28, 2018.


Please also note the supplement to this comment: https://www.clim-past-discuss.net/cp-2018-162/cp-2018-162-RC3-supplement.pdf

### Anatolia 4.2 ka BP event paleoclimate proxy sites

<table>
<thead>
<tr>
<th>Proxy site</th>
<th>Lat.</th>
<th>Long.</th>
<th>Publication</th>
<th>status</th>
<th>Resolution/yrs</th>
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<tbody>
<tr>
<td>Sofular Cave</td>
<td>41.417</td>
<td>31.95</td>
<td>Gökőr et al 2011</td>
<td>wet</td>
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<tr>
<td>Gulf of Gemlik</td>
<td>40.463</td>
<td>28.895</td>
<td>Filik et al 2017</td>
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<tr>
<td>Lake Iznik</td>
<td>40.433</td>
<td>29.508</td>
<td>Ülgen et al 2012</td>
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<tr>
<td>Lake Tecer</td>
<td>39.431</td>
<td>37.084</td>
<td>Kutucuğlu et al 2011</td>
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<td>Eski Acıgöl</td>
<td>38.547</td>
<td>34.546</td>
<td>Roberts et al 2001</td>
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<tr>
<td>Lake Hazar</td>
<td>38.5</td>
<td>39.3</td>
<td>Ön et al 2018</td>
<td>wet</td>
<td>175</td>
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<tr>
<td>Nar Gölü</td>
<td>38.34</td>
<td>35.456</td>
<td>Dean et al 2015</td>
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<td>5</td>
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<tr>
<td>Konya Lakes</td>
<td>37.483</td>
<td>33.453</td>
<td>Boyer et al 2006</td>
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<td>Koçain Cave</td>
<td>37.233</td>
<td>30.712</td>
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<td>cold</td>
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<td>Göbekli Tepe</td>
<td>37.223</td>
<td>38.923</td>
<td>Pustovoytov et al 2007</td>
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<td>Göltar Gölü</td>
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<td>29.6</td>
<td>Leng et al 2010</td>
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<tr>
<td>Lake Van</td>
<td>38.592</td>
<td>42.847</td>
<td>Lumscke, Sturm 1997</td>
<td>dry</td>
<td>116</td>
</tr>
</tbody>
</table>

**Fig. 1.** Weiss 2019 CP
Fig. 2. Weiss 2019 Apr 3 Fig 2 Lake Hazar del$^{13}$C and del$^{18}$O