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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

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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 δ13C and δ18O 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).

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https://www.clim-past-discuss.net/cp-2018-162/cp-2018-162-RC3-supplement.pdf

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Anatolia 4.2 ka BP event paleoclimate proxy sites

Proxy site	Lat.	Long.	Publication	status	Resolution/yrs
Sofular Cave	41.417	31.95	Göktürk et al 2011	wet	5
Gulf of Gemlik	40.463	28.895	Filikci et al 2017	dry	>200
Lake Iznik	40.433	29.508	Ülgen et al 2012	dry	-
Lake Tecer	39.431	37.084	Kuzucuoğlu et al 2011	dry	-
Eski Acigöl	38.547	34.546	Roberts et al 2001	uncertain	85
Lake Hazar	38.5	39.3	Ön et al 2018	wet	175
Nar Gölü	38.34	35.456	Dean et al 2015	dry	5
Konya Lakes	37.483	33.45	Boyer et al 2006	dry	-
Koçain Cave	37.233	30.712	Göktürk 2011	cold	2
Göbekli Tepe	37.223	38.923	Pustovoytov et al 2007	dry	>100
Golhisar Gölü	37.117	29.6	Leng et al 2010	dry	98
Lake Van	38.592	42.847	Lemcke, Sturm 1997	dry	116

Fig. 1 **Weiss 2019 CP**

Fig. 1. Weiss 2019 Apr 3 Fig 1 Anatolia 4.2 ka BP event paleoclimate proxy sites

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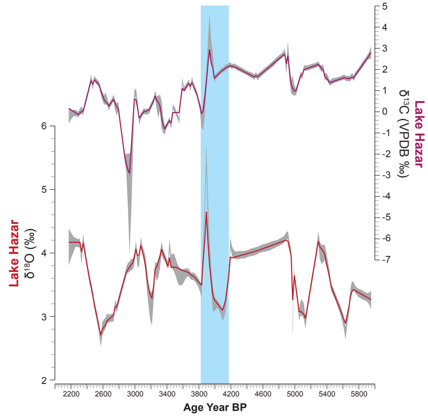

Fig. 2. Weiss 2019 Apr 3 Fig 2 Lake Hazar del13C and del 18O

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