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Climate variability controlled the development of the pre-Viking society during the Late Antiquity in Southeastern Norway

Manon Bajard^{1,2}, Eirik Ballo^{1,2}, Helge I. Høeg³, Jostein Bakke⁴, Eivind Støren⁴, Kjetil Loftsgarden³, Frode Iversen³, William M. Hagopian², Anne H. Jahren², Henrik H. Svensen^{1,2}, and Kirstin Krüger¹

¹Department of Geosciences, University of Oslo, Oslo, Norway

²Centre for Earth Evolution and Dynamics, University of Oslo, Oslo, Norway

³Department of Archaeology, Museum of Cultural History, University of Oslo, Oslo, Norway

⁴Department of Earth Science and Bjerknes Centre for Climate Research, University of Bergen, Bergen, Norway

Understanding how agricultural societies were impacted and adapted to past climate variations is critical to face to contemporary climate change and guaranty the food security (#SDG2 Zero Hunger). However, linking climate and change in the behaviour of a population are difficult to evidence. Here, we studied the climate variations of the period between 200 and 1300 CE and its impact on the pre-Viking and Viking societies in Southeastern Norway, including the adaptation and resilience of the agricultural management. This period includes, between 300 and 800 CE, one of the coldest period of the last 2000 years. We used a retrospective approach combining a multi-proxy analysis of lake sediments, including geochemical and palynological analyses, to reconstruct past changes in temperature and agricultural practices during the period 200-1300 CE. We associated variations in Ca/Ti ratio as a result of change in lake productivity with the temperature. The periods 200-300 and 800-1300 CE were warmer than the period between 300 and 800 CE, which is known as the “Dark Ages Cold Period” in the Northern Hemisphere. During this colder period, phases dominated by grazing activities (280-420 CE, 480-580 CE, 700-780 CE) alternated with phases dominated by the cultivation of cereals and hemp (before 280 CE, 420-480 CE, 580-700 CE, and after 800 CE). The alternation of these phases is synchronous of temperature changes. Cold periods are associated to livestock farming, and warmer periods to crop farming. This result suggests that when temperature no longer allowed crop farming, the food production specialized in animal breeding. The result of a Principal Component Analysis show a succession of phases of crisis, adaptation and resilience of the socio-environmental system. The Viking Age (800-1000 CE) started with an increase in temperature and corresponds to the warmest period between 200 and 1300 CE, allowing a larger development of the agriculture practices and society. Our results prove that the pre-Viking society adapted their agricultural practices to the climate variability of the Late Antiquity and that the Vikings expanded with climate warming.