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Magnetic Mineral diagenesis in changing water environments in the Black Sea since ∼41.6 ka

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Magnetic mineral diagenesis plays a key role in the global iron cycle. To understand the authigenic magnetic mineral formation by diagenesis is also fundamentally important for the interpretation of environmental magnetic as well as paleomagnetic signals. Core MSM33-55-1, recovered from the SW Black Sea, was subjected to rock-magnetic and SEM studies. The results demonstrate that four different magnetic mineral assemblages associated to specific water conditions can be observed. Between ∼41.6 ka and ∼19 ka, magnetite and greigite are alternatively in dominance in the sediment. Due to low organic matter input during the late MIS 3 and the last glacial maximum (LGM), oxygenated bottom water in the Black Sea was favourable for preserving detrital magnetite. Greigite in this interval have irregular shapes and assemble in spots, which were formed in a micro environment with limited sulfate availability. Between ∼19 ka and ∼16.5 ka, black layers were deposited as a result of organic matter accumulation induced by productivity blooming and riverine discharge soaring after the LGM. Hence less oxygenated bottom water conditions developed, and more fine grained greigite was formed. After melt-water pulse (MWP) events (∼16.5 ka), both primary productivity and the sea level were continuously rising until ∼8.3 ka, leading to the depletion of oxygen in bottom water. In addition to greigite, pyrite was also formed and gradually in dominance as approaching the Holocene. The influx of salt water masses from the Mediterranean Sea after ∼8.3 ka contributed to the establishment of the anoxic Black Sea, which resulted in the formation of ubiquitous frambiods of pyrite. Additionally, bacterial magnetic minerals are likely present in the sediment younger than ∼8.3 ka as indicated by rock magnetic results. In this paper, four different magnetic mineral assemblages, reflecting gradual changes from an oxic to an anoix Black Sea, were identified, yielding insights into the relation between magnetic minerals diagenesis and bottom water conditions.