First archeointensity results from four types of ancient kilns excavated in Burkina Faso (West Africa)

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Abstract: In this work we focus on the determination of the geomagnetic field intensity from iron smelting kilns that were discovered at the metallurgical site of Korsimoro in Burkina Faso. A large number of kilns are found at this site, which extends over an area up to 50 km^2. Based on archeological investigations, the kilns can be related to four different types of smelting techniques, which belong to four distinct time periods. Radiocarbon ages were obtained from charcoal and confine the studied kilns to ages ranging from 700 to 1800 AD. Rock-magnetic investigations on representative samples show that the main ferromagnetic mineral is magnetite. One kiln also shows a significant contribution of hematite and a high coercivity-low unblocking temperature magnetic phase (McIntosh et al., 2007). Preliminary archeointensity results of 26 specimens show an intensity variation of the geomagnetic field between 20 – 40 □T. The failure rate is relatively high with 13 unsuccessful specimens. They did not pass the quality criteria mainly because they show a pronounced concave Arai diagram, which is typical for grains with different unblocking and blocking temperatures. On the contrary, most successful specimens show Arai diagrams with straight slopes. The preliminary new intensity data of Korsimoro are illustrated in Figure 1, and are compared to the ARCH3K.1 global geomagnetic field model (Korte et al., 2009), archeointensity data from Morocco from the Geomagia50 database (Korhonen et al., 2008; Donadini et al., 2006). The new archeointensities presented here are the first results from Burkina Faso and will compliment the directional paleosecular variation curve from West Africa (Donadini et al., 2014) to further constrain the geomagnetic field variations in this region. New data from western Africa are very important in order to improve the global geomagnetic field models that up to now are mainly based on input data from Europe. Additionally, the magnetic results contribute to understanding the organization of the smelting techniques applied at Korsimoro better and offer information about the succession of the smelting events. The intensity data together with the directional paleosecular variation curve can be used in future studies to constrain ages of archeological artifacts with little or no datable organic material for radiocarbon dating.

Keywords: archeointensity, West Africa, iron smelting kiln, Burkina Faso, West Africa

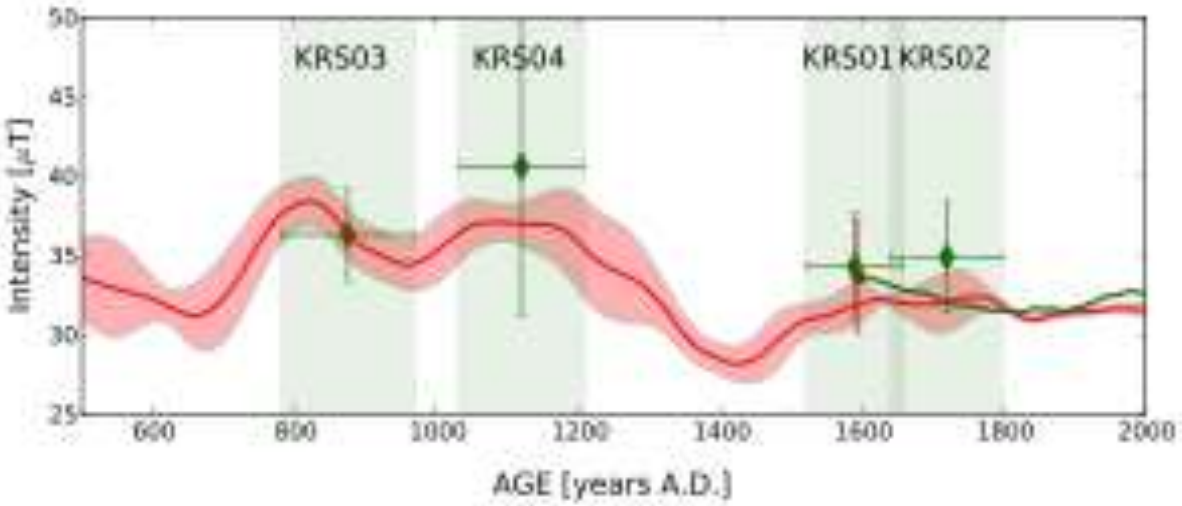

Figure 1: Variations of the geomagnetic field intensity at Korsimoro during the last 1500 years. The red curve is the ARCH3K.1 geomagnetic field model (Korte et al., 2009), green diamonds are preliminary data from Korsimoro, and the red circle represent data from Morocco from the Geomagia50 database (Korhonen et al., 2008; Donadini et al., 2006), relocated at Korsimoro.

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