Rock-magnetic and paleomagnetic study from the ancient harbor of Rome (Italy) during the first millennium AD

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Abstract: High-resolution sedimentary archives are key to reconstruct past changes of the Earth's magnetic field in a continuous way. The typical sedimentation rates (10 to 100 cm/ka) of lacustrine or marine records commonly allow reconstructing the millennial-scale variability. Recently, Goiran et al (2010) revealed exceptionally high sedimentation rates (up to 1000 cm/ka) in the ancient harbour of Rome, which was constructed on the Tyrrhenian Sea during the first century AD and filled up with fine sediments during the first millennium AD. Here we present a high-resolution rock-magnetic study investigating if the sediments of the ancient harbor of Rome have genuinely recorded Earth's magnetic field variability at an unprecedented temporal resolution.

Pilot rock-magnetic analysis (including hysteresis properties, natural remanent magnetization, and temperature-dependent magnetic susceptibility) of sediment extruded during previous drilling operations in Portus revealed that the man-made paleochannel *canale Traverso* linking the Tiber River to the harbor is a promising site for a continuous high-resolution paleomagnetic study. In particular, the sedimentary infill in *canale Traverso* is characterized by pseudo-single-domain ferrimagnetic minerals such as magnetite and displays a strong and stable natural remanent magnetization. In September 2011, two undisturbed sedimentary sequences (CPS-1 and -2) were successfully recovered at the junction of the *canale Traverso* and the ancient harbor using the hydraulic piston corer of the *Centre d'Étude Techniques de l'Équipement* (CETE) *Méditerranée*. Detailed magnetic and physical analysis were performed on the whole core sections (CT scan, magnetic susceptibility and gamma ray attenuation at 1 cm intervals), the half core sections (core scanning imaging, magnetic susceptibility and spectrophotometer at 0.5 cm intervals) and u-channel samples from

core CPS-1 (natural and anhysteretic remanent magnetization at 1 cm interval) at the *Institut des sciences de la mer de Rimouski* (ISMER).
The *canale Traverso* sediment infilling consists of silt with molluscs, ceramic shards and wood fragments overlaying the Tiber delta deposit at the base. Stratigraphic and magnetic susceptibility correlation with other available sedimentary sequences from Portus (Goiran et al., 2010; Sadori et al., 2010; Salomon et al, 2012) reveal a maximum *canale Traverso* infilling of ca. 4 m at site CPS1. Rock-magnetic and u-channel based paleomagnetic results of that sedimentary sequence reveal generally low coercivity magnetic minerals, stable NRM and geomagnetic inclination varying around the geocentric axial dipole (GAD) value calculated for the coring site, indicating the possible recording of a genuine geomagnetic signal at an unprecedented decadal resolution. In addition, a series of short intervals with higher coercivity and unstable NRM interrupt the record and reveal complex magnetic assemblages hinting at dredging events and Tiber River influence in the *canale Traverso*. Ongoing rock-magnetic analysis of a series of cube samples are conducted at The Australian Archeomagnetism Laboratory (TAAL) in order to further investigate the magnetic mineral assemblages and their geo-archaeological and paleoenvironmental implications.

Keywords: sedimentary paleomagnetism, rock-magnetism, paleoenvironment, geoarchaeology

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