Variation of the Earth's Magnetic Field Strength in South America During the Last Two Millennia, New results from Historical Buildings of Buenos Aires and Re-evaluation of Regional Data

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Abstract: The causes of systematic decay of the Earth's Magnetic Field strength since eighteen century have been a matter of debate during the last decade. It is also well known that such variations may have completely different expressions under areas characterised by strong magnetic anomalies such as the South Atlantic Magnetic Anomaly. To understand these atypical phenomena, it is crucial to retrieve the past evolution of Earth´s magnetic field beyond of observatory records.

We report a detailed rock-magnetic and archeointensity investigation on some well-studied historical buildings of city of Buenos Aires located in the heart of the South Atlantic Magnetic Anomaly. Samples consist of bricks, tiles, fireplaces and potteries which are considered as highly suitable materials for archaeointensity studies. The dating is ascertained by historical documents complemented by archeological constraints. Eighteen out of 26 analysed samples yielded reliable absolute intensity determinations. The site-mean archaeointensity values obtained in this study range from 28.5 to 43.5 mT, with corresponding virtual axial dipole moments (VADMs) ranging from 5.3 to 8.04 10^{22} Am^2. Most determinations obtained in the present study show remarkable agreement with values predicted by time varying field model CALS10k.1b suggesting that both absolute intensity and age estimations are reliable.

South American database now includes absolute intensities from AD 400 to AD 1930 based on 63 reliable archaeointensity determinations. The data set shows several distinct periods of quite large fluctuations of intensity. However, most data are concentrated into a relatively narrow interval from AD 1250 to AD 1450. At the

beginning of the record, data between AD 400 and AD 830 matches well with ARCH3K model. Some general features may be detected: the time intervals from about AD 400 to AD 950 and AD 1150 to AD 1280 are characterised by a quite monotonic decrease of geomagnetic intensity, while some increase is observed from AD 950 to AD 1250. In contrast, well-defined intensity decay is detected from AD 1550 to AD 1930 in excellent agreement with the model data. We found no evidence of firm correlation between the climate changes over multi-decadal time scales and geomagnetic intensity.

Keywords: Earth's Magnetic Field, Secular Variation, archaeomagnetism, South America, Argentina