MAGNETOTELLURIC FIELD ANOMALIES AND THE SECOND-ORDER MAGNETIC PHASE TRANSITION

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The ferro(i)magnetic-paramagnetic change, taking place in a few degree wide temperature range at the critical (Curie or Néel) temperature is a second-order magnetic phase transition. A possible extreme (theoretically infinite) enhancement of magnetic susceptibility (the Hopkinson peak, or the "lambda-type" anomaly) of magnetic materials around this temperature has been known for a long time. If the enhancement is sufficiently high, it is able to cause important geomagnetic and magnetotelluric anomalies (Kiss et al., GRL, 2005). The anomaly source is a thin (a few hundred meters thick) layer, with exponentially increasing induced magnetization toward its centre, which is just at the Curie (Néel) depth of the actual magnetic earth material. Some deep geomagnetic anomalies of unknown origin (widely assumed to be due to large-size, commonly magnetized rocks down to the Curie depth) can be well explained in this way. The magnetic susceptibility is usually neglected in magnetotellurics, thus, as we demonstrated, classical inversions lead to a very high-resistivity (up to several thousand ohmmeters) and very thick (up to several ten kilometres) layer, starting at mid-crustal depths. In this paper we discuss the magnetotelluric consequences. Besides direct and inverse results we present field MT sounding curves (first of all from the Pannonian Geotraverse), where such an effect may take place. The phenomenon seems to be mostly developed systematically in the same (TE?, TM?) mode curves, and especially in their Occam inversion results, which have significant bulges, beginning around the possible Curie depth of the magnetite. Such sites seem to be situated not randomly over magnetic anomalies. The laboratory aspects and other bulk physical parameters related to the second-order magnetic phase transition are discussed in a companion paper in session I.06. Acknowledgement: Hungarian Scientific Research Fund, T68475.

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