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Methodology of Detailed Geophysical Examination of the Areas of World Recognized Religious and Cultural Artifacts

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It is obvious that noninvasive geophysical methods are the main interpreting tools at the areas of world recognized religious and cultural artifacts. Usually in these areas any excavations, drilling and infrastructure activity are forbidden or very strongly limited.

According to field experience and results of numerous modeling (Eppelbaum, 1999, 2000, 2009a, 2009b; Eppelbaum and Itkis, 2001, 2003; Eppelbaum et al., 2000, 2001a, 2001b, 2003a, 2006a, 2006b, 2007, 2010, Itkis et al., 2003; Neishtadt et al., 2006), a set of applied geophysical methods may include the following types of surveys: (1) magnetic, (3) GPR (ground penetration radar), (3) gravity, (4) electromagnetic VLF (very low frequency), (5) ER (electric resistivity), (6) SP (self-potential), (7) IP (induced polarization), (8) SE (seismoelectric), and (9) NST (near-surface temperature). As it was shown in (Eppelbaum, 2005), interpretation ambiguity may be sufficiently reduced not only by integrated analysis of several geophysical methods, but also by the way of multilevel observations of geophysical fields. Magnetic, gravity and VLF measurements may be performed at different levels over the earth's surface (0.1 – 3 m), ER, SP and SE observations may be obtained with different depth of electrodes grounding (0.1 – 1 m), and NST sensor may be located at a depth of 0.8 – 2.5 m. GPR method usually allows measuring electromagnetic fields at various frequencies (with corresponding changing of the investigation depth and other parameters). Influence of some typical noise factors to geophysical investigations at archaeological sites was investigated in (Eppelbaum and Khesin, 2001).

In many cases various constructions and walls are in the nearest vicinity of the examined artifacts. These constructions can be also utilized for carrying out geophysical measurements (magnetic, gravity and VLF) at different levels. Application of the modern ROV (remote operated vehicles) with registration of magnetic and VLF fields at the low altitudes (3-5 meters) will help geophysical cover all the studied area with a regular observation step (Eppelbaum, 2008). At the final step all these measurements (including results of the previous works) could be compiled to 4D models of different geophysical parameters (Eppelbaum and Ben-Avraham, 2002; Eppelbaum et al., 2010).

Analysis of temperature field in the boreholes drilled in the vicinity of the studied site will permit to estimate the temperature (e.g., Eppelbaum et al., 2006c) in the historical period when this artifact was constructed and, correspondingly, utilize this characteristic for investigation of mechanical and other properties of the ancient building material.

Studying of temporal variations of magnetic (e.g., Finkelstein and Eppelbaum) and VLF fields can be also used for determination of nature of some buried ancient remains.

The geophysical investigations must be combined with geochemical, paleostructural, paleobiogeographical, paleomorphological and other methods (Eppelbaum et al., 2010). Application of informational parameters (Khesin et al., 1996; Eppelbaum et al., 2003b) will permit to present all available data by the use of integral convolution units.

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