RESEARCH OF SHORT-PERIODICAL VARIATIONS OF INTENSITY OF THE GEOMAGNETIC FIELD IN SECOND HALF OF FIRST MILLENNIUM BC

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Abstract. As a result of research of residual magnetisation of narrowly dating ceramics (amphoras with the seals) by the modified Thellier’s method were obtained the data about intensity of a geomagnetic field in East Mediterranean during V-III centuries BC. It was constructed averaged 11-annual curve for V-IV centuries BC that has allowed to find out "centenary" variation of intensity of a field on this time interval.

For research “short-periodical” (with the periods in some tens – first hundreds years) variations of intensity of a geomagnetic field it is necessary to have detailed numbers data in hundreds years. Such data authors managed to receive only for of some areas of East hemisphere (from Spain up to Central Asia) for separate time intervals of last eight millennia [Burakov, et al. 2005; Nachasova, 1972; Nachasova, Burakov, 1994; 1995; 1998; Nachasova, et al., 2007]. In all cases in change of intensity of an ancient geomagnetic field have been found out “short-periodical” variations. They have been allocated in change of intensity of a field in VI–V, II millennia BC. and last two millennia.

Research of variation of intensity of a geomagnetic field in I thousand BC, lead on magnetization of a ceramic material from archeological monuments of Black Sea Coast (Crimea and Taman peninsulas) [Nachasova, Burakov, 2002; Nachasova, et al., 2007], has shown, that “short-periodical” variations are allocated not on all temporary pieces. So “centenary” fluctuation is allocated in variation of intensity of a geomagnetic field on a time interval II century BC. – II century AD., and practically it is not appreciable on more ancient temporary piece (V – III centuries BC.) on which, there is a fast sharp falling intensity of a geomagnetic field in I a millennium BC. On I thousand BC. the maximal values of intensity of a geomagnetic field for all period of last eight millennia have and during same time occurs there is one of the most essential changes of an average level of intensity of a field that does especially interesting research of structure of variations of a field during this period.

For finding-out of a question on existence of a "centenary" variation on temporary piece V – III centuries BC., it was necessary receptions of some data about intensity of a field on magnetization of a ceramic material with narrow (within the limits of 20 – 30 years) dating. Such material is the imported ceramics from islands of east part of Mediterranean sea and from Asia Minor which is dated much more precisely, than the Caucasian and Crimean ceramics. The ceramics from islands of east part of Mediterranean sea (Kos, Lesbos, Fasos, Chios, Rhodes, etc.) and from Asia Minor (the cities of Gerakleja and Sinop) has been selected. The collection will consist of fragments of the amphoras selected from cultural adjournment of archeological monuments of peninsula Taman (basically from Phanagoria).

Laboratory researches have been lead by means of the variant of Thelliers technique modified by authors (with amendments on anisotropy and chemical changes) [Burakov et al., 2005]. The researches lead earlier, have shown, that the regular divergence of the data received on materials from different areas of region east Mediterranean – Black Sea Coast is not present.

For construction of a picture of variation of intensity of a geomagnetic field in second half of I thousand BC 61 determinations have been used. The determinations received on samples from one object (with one dating) were averaged. On a data set by means of sliding averaging the curve of variation of intensity of a field in V – IV centuries B.C., presented on Fig. 1 (the filled in points) is constructed. Interval of averaging – 11 years, shift – 10 years. Determinations of intensity of the geomagnetic field, received on a material, dated as III century BC. - only six. Obtained data are shown on fig. by hollow points.
The data received during the present research, have enabled to construct a curve of change of intensity of a geomagnetic field with a much greater detail and accuracy, than earlier. On this curve it is possible to allocate confidently time pieces on which the average level of intensity of a field varies a little. It is first half V of century B.C. and the second - the third quarters of IV century B.C. Distance between the middle of these time pieces approximately 120 – 130 years. Such kind of change of intensity of a field is reflection of a "centenary" variation. Fluctuation can be tracked on a time interval second half V – IV century B.C. It passes on a background of almost constant average level of intensity of field, its characteristic time can be defined approximately in 110 years. Thus, specification of a picture of change of intensity of a geomagnetic field on time interval V – IV centuries B.C. has allowed to find out a "centenary" variation of intensity of a field on this time interval.

In the previous research mentioned above, the "centenary" variation on this time site has not been allocated, that, apparently, has been connected, on the one hand, with prevailing falling intensity of a field during second half of I millennium B.C., with another, - with influence of wide dating the investigated material led some distortion of a picture of change of intensity of a field on this time interval.

That with the greatest probability to exclude influence of mistakes of definitions of intensity of a geomagnetic field at an assessment of limits of variation of intensity of a geomagnetic field on a considered time interval, from the received definitions the definitions received with high accuracy and certainty have been selected only.

The definitions received on a material have been taken, which magnetic characteristics do not change after heatings (by results of research of variation of a magnetic susceptibility during heatings), and for which type of parity In/Irt (natural residual magnetization and thermomagnetization), as well as the constancy of a direction of vectors partial thermomagnetizations attests to absence of secondary heatings. It has allowed to receive determinations of intensity of an ancient geomagnetic field with the least deviation from true values (39 determinations).

The picture of change of intensity of a field is well traced and on this data set (crosses on figure). On a curve constructed on the most exact data, "centenary" variation are shown more precisely. The maximum of a "centenary" variation is more brightly allocated, it is necessary on the middle of IV century B.C. The first minimum of this fluctuation is necessary on IV quarter of V century B.C. Position on a time scale of the
second minimum of centenary fluctuation is defined less precisely, it is necessary approximately on a boundary IV – III centuries B.C. (probably – on IV quarter of IV century B.C.).

Thus, received for V and IV centuries B.C. data about intensity of a geomagnetic field speak about presence of a "centenary" variation in this time interval, that in aggregate with results of some the previous researches testifies to a continuity of existence of this variation on an extent at least last two millennia.

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References


