

Palaeomagnetic investigations at Biriuchya Balka 2 (2003)

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Summary

104 samples were taken in 2003 from the northern section at BB2 at depths from 925 to 1205 cm (a 280 cm column). All except 5 samples were taken in glass ampoules. Five (nos. 98, 100, 101, 103, and 104) were taken in aluminium containers, but the results from these samples were not considered satisfactory. The primary measurements carried out were as follows.

1. changes in magnetic susceptibility [K , $\times 10^{-3}$ SI units]
2. natural remanent magnetism [J_n , mAm/m]
3. declination [D , °]
4. inclination [I , °]

From the top down, values for the first two measurements were as follows.

Samples	K	J_n	Layer
1-22	0.4	15	reddish brown loam
23-83	0.5	20	brownish grey loam
84-104	0.2	5	greenish alluvium

A decrease in magnetic susceptibility is therefore observed at the base of the section. This may be linked, either with a change in the amount and type of ferromagnetic minerals present, or with a decrease in the intensity of the geomagnetic field.

The results for D and I provided the following commentary. For samples 1-91, D varied within a range of 40° [-10° to $+30^\circ$]. Sample 91 is at a depth of 1150 cm, hence samples 92 and 93 (the object of special attention) will have been immediately below that. The values for I likewise varied within a range of 20° [20° - 40°]. Below sample 91, however, there was an increase in the range to 50° [10° - 60°]. In this part of the section, there was also a clear decrease in the values for J_n (see above), but not much change in D , except for sample 93. This sample was also found to be different in terms of magnetic viscosity.

A stereogram was provided for J_n , in which samples 92 and 93 occupied clearly deviant positions. The average values for $D=11.1^\circ$ and for $I=+31.8^\circ$. 'These values do not agree with the average values for a stationary field of a central axial dipole at the place where the samples were taken', i.e., 47.5° N latitude and 41.0° E longitude at BB2, 'which would correspond to $D=0^\circ$ and $J_n=65^\circ$ '.

Palaeomagnetic characteristics for all the samples were presented in Table 1. The results for samples 92 and 93 were as follows.

Sample	K	J _n	D	I
92	0.26	8.5	87.3	42.3
93	0.19	5.0	207.8	58.3

It is considered that samples 92 and 93 show a possible excursion. In Table 2 the coordinates of the virtual geomagnetic poles for these samples were given as follows.

Sample	N latitude °	E longitude °
92	19.5	115.7
93	0.0	19.7

All the other measurements given fall within the limits: N latitude 43.0-63.9°, longitude 143.7-240.9°.

The concluding argument is that, since the age of the section exceeds 30,000 years, the changes noted in D and I may be linked to the Kargapolovo excursion, the beginning of which is put at 40-42,000 years and its duration at 2000 years (G.N. Petrova, T.B. Nechaeva, G.A. Pospelova, 1992, *Kharakternye izmeneniya geomagnitnogo polya v proshlom*). Usually excursions take place against a background of reduced geomagnetic field intensity. In the section there has been observed a marked change in the magnitude of natural remanant magnetism J_n (x 3.5) and in magnetic susceptibility K (x 2). This does not allow us to demonstrate conclusively that there was an excursion (particularly in view of the problems with the aluminium containers) but the existence of such an excursion is probable. More careful work should be carried out on this part of the section in future (*and it is intended that this will be done now, in 2004*).

Coordinates were calculated for the virtual geomagnetic poles for 20 samples (see above) including the section with the supposed excursion (samples 85-104). The position and succession of these virtual poles at BB2 was shown at Figure 4, with which was compared Figure 5, the same for the section at Yangiyul' in Uzbekistan, where the Kargapolovo excursion was found (G.A. Pospelova, G.N. Petrova, Z.V. Sharonova, 1998, *Geomagnitnoe pole vo vremya i posle ekskursov, zapisannykh v rasreze Yangiyul'*, *Fizika Zemli*, pp. 65-79). The two Figures are similar, which suggests that we do also have the Kargapolovo excursion at BB2, but further work is needed to confirm this, using glass ampoules only.

paj
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(with apologies if the technical expressions are not always quite correct, based on notes made in the field at Kremenskoï)