From Urals to Altaiids—structural continuity?

Hugo de Boorder (Institute of Earth Sciences, Utrecht; CERCAMS, London) & Maarten Zeylmans van Emmichoven (Faculty of Geosciences, Utrecht)

In view of the known mineral endowment of the exposed late Palaeozoic arcs in western Kazakhstan, Uzbekistan, Kyrgyzstan, and Turkmenistan, the continuity of these arcs below Cenozoic sediments in the Aral Sea region must, eventually, be of interest in exploration.

Magnetic data suggest continuity between the Valerianov Arc in the eastern Urals and the Belbuk-Kezara Arc in the Tien Shan (Harrison et al., in press). However, the magnetic anomaly patterns in the NGDC database (1996), reproduced from the original map (Makarova et al., 1974), with a final grid between -119°E and -120°E, are difficult to assess, particularly in grey-scale text figures.

Here, we examine the original magnetic anomaly map in conjunction with satellite images ("Ms. Sid") format and the Mineral Deposits Map of Central Asia (Seltmann and Shatov, 2001). Maps and images are projected in WGS84.

Fig. 1 - Magnetic Anomaly Map of the Aral Sea region (NGDC, 1996).

Fig. 2 - Parts of four sheets of the original magnetic anomaly map (Makarova et al., 1974) of the Aral Sea region. Note that positive values are here in blue and negative values in pink. Local highs and lows help to identify continuity and extent of regional anomalies. Sheet matching is problematical. Area in yellow box is enlarged in Figs. 4 and 6.

Fig. 3 - Satellite imagery of Aral Sea region. "Ms. Sid" format of Landsat TM frames, RGB bands 7, 4 and 2. Area in red box is enlarged in Figs. 5 and 6.

Fig. 4 - Enlargement of magnetic anomaly map in Fig. 2 (yellow box). A long positive, NNE-striking anomaly belt (see also Figs. 6 and 7) diverges to ESE, striking across a ca. 400 km long ENE-striking discontinuity ("Aral Fault System"; Fig. 5A). The NNE-striking branch of the regional anomaly is thought to represent the Valerianov Arc on the basis of the distribution of iron ore deposits (Seltmann and Shatov, 2001) between 51°N latitude and 54°N latitude (Figs. 6 and 7).

Fig. 5 - Enlargement of satellite imagery in Fig. 3 (red box). The pattern of variably sized lakes (black) along the Turghai River is thought to reflect an over 400 km long, ENE-striking shear zone complex by en echelon- and horseshoe-like features ("Turghai Shear Zone") in the Cenozoic-covered Palaeozoic basement. In Fig. 5A, lakes are marked red and inferred principal shear trends in black.

Although hardly noticeable on the ground, the strike of magnetic anomalies along its northeastward projected extent which leads into fault systems with the same strike in the northwestern part of the Kazakhstani block and (b) the curvature in the anomalies associated with the Fergana Fault System (see Figs. 6 and 7).

Fig. 6 - Magnetic anomaly pattern with interpreted Valerianov Arc and its southern branch, the Aral Fault System (Fig. 4), and the Turghai Shear Zone (Fig. 5), arcs south of the southern branch of the Valerianov Arc and known ore deposits (Seltmann and Shatov, 2001).

Fig. 7 - Fig 6 superimposed on the Mineral Deposits Map of Central Asia (Seltmann and Shatov, 2001).

Preliminary results

Magnetic anomalies suggest continuity below Cenozoic cover of the Valerianov Arc from the Urals to the Altaiids; the arc is deflected and probably strongly deformed along the ENE-striking Aral Fault Zone.

Lake distribution along the Turghai River suggests an ENE-striking tectonic discontinuity below Cenozoic cover; this tends to find support in magnetic anomalies with similar strike that extend into the Kazakhstani block.

Across this discontinuity, the SE-NW Fergana magnetic trend deflections to NE.

The kinematics and mineral potential of the inferred ENE-striking deep discontinuities are unknown.

The Muruntau gold deposit is hosted by an arc system south of the southern branch of the Valerianov Arc.

A group of mercury deposits tends to cluster along the Central Ust Yurt Fault.

References


