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UAV magnetic survey for geological exploration: A case study of the Synnyr Massif, Buryatia, Russia

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The Synnyr alkaline massif is a concentrically zoned body located in the Baikal Vitim folded area, Holodninskiy graben. It is controlled by the deep-seated Precambrian Baikal-Synnyr fault, while major rock types of the massif were dated as 230-350 Ma (Kostuk et al., 1990; Mitrofanova 2009). However, there were no young strike-slip faults or thrusts identified throughout the massif. Studying the area is compounded by the climate and landscape conditions, which makes the airborne geophysical survey a very cost-effective mapping tool. Main geological investigations of the Synnyr massif were made in the 1960s and in the 1980s. In those times, an airborne geophysical survey was not as accurate as it was required and didn't bring up any significant results.

The next stage of Synnyr massif exploration began in 2016. The first airborne magnetic survey based on unnamed aerial vehicles (UAV) was made in 2018 and increased our knowledge about the geological situation in the studying area. Main goals of the UAV magnetic survey were tracing highly magnetic foidal gabbroids named shonkinites, which are located in the central part of the ore zone, and mapping major faults.

The airborne geophysical complex included a multicopter aerial vehicle and quantum magnetometer with a rubidium magnetic field sensor that was placed in the special gondola and attached to the UAV. The study area was surveyed at 20 meters height with detailed terrain following and accuracy of magnetic field measurements comparable with the ground magnetic survey.

As a result, airborne magnetic data helped to clarify geological structure and tectonics in the areas covered with glacier or without any outcrops. Furthermore, magnetic field measurements allowed to locate faults and lineaments which were not traced in previous geological studies of the Synnyr massif and to make an assumption about the neotectonic activity of Baikal-Synnyr fault system.

Due to cost-efficiency, informativeness and high accuracy of geophysical surveys based on UAV, we are planning to continue research and extend the studying area.

References:

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