
**High Accuracy Ground Magnetic Survey was Applied in the Khammouane Potash Deposit, the Lao P.D.R: An Efficient and Fast Exploration Model of Potash Deposits in Covered Areas**

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**Abstract**

The period and cost of mine exploration in new strange areas are very strict and very little geological data is available. The working area is usually covered by the exuberant vegetation, so the surface observation is very difficult and the working environment is very harsh. This paper introduces the application of high-precision ground magnetic method to the rapid, efficient and low-cost prospecting of favourable areas for mineralization in Khammouane Potash Deposit, the Lao P.D.R.

**1 Introduction**

Khammouane Potash Deposit is in the northeast of Nongbok in the province of Khammouane, and is 380 km far from the Vientiane, the capital of the Laos P.D.R. Mekong River which is to the west of the deposit is the main river in the Southeast Asia. The study area has a relatively flat topography, with low dissection. Its elevation varies from 120 to 160m that was relatively small.

Looked from the development history of the regional structure in this district, there was no evidence of the metamorphism, the Magmatism was feebleness and the Deposition was fierceness. There was thick gray volcanic Terrigenous detrital sediment with the rift subsidence in the early Mid-permian. The red terrigenous detrital sediment uplifted gradually after sedimentated from the Jurassic to the Cretaceous period. In the early of the Paleocene, rift subsided to form sedimentary basin, which laid by the red terrigenous detrital sediment and huge thick plaster salt by turns; the whole stratums uplifted in the later Quaternary and ended by gray white terrigenous detrital sediment. The geological history was divided Cretaceous, Paleocene and Quaternary in accordance into four stages, which Mid-permian-Trias-Jurassic- with the forming and evolvement of the sedimentary basin (Cheng et al., 2010; Feng et al., 2005; Zhong et al., 2012).

**2 The magnetic characteristic of the rock**

The main lithology was the mudstone and the salt rock, the sylvite and the gypsum. According to the geological condition, the basis fluctuation and abnormity distributes of the sedimentary deposit could be examined by the high-precision magnetic survey. Looked from the characteristic of the regional tectogenesis and deposition, the target layer (more than 500m) was rock salt, mudstone, gypsum and sylvite, which all were weak magnetic material (magnetic susceptibility <50). Ferromagnetic materials mainly distributed in magma and the old layer before the Cretaceous (Magnetic susceptibility >200). It was looked as the base of the magnetic survey. It illuminated that avail area to form mine was negative magnetic abnormity in this district.

**3 The methods in work field**

The HC-95 ground helium optically-pumped magnetometer, which was made by China Aero Geophysical Survey & Remote Sensing Center for the Ministry of Land and Resources P.R.C, is used in this program. The instrument with a specified accuracy of 0.05 nT and the rate of sampling between 1 to 5 per second can display the numerical value and curve which are stored by manual operating at the same time.

In order to eliminate the interference to the magnetometer from the sun and avoid the mistake of the reading on the magnetometer aroused by magnetic storm, we used one magnetometer, which can store data every time by 10s, to observe the geomagnetic daily variation, and used another to manual measure by moving.

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Simultaneity, we used a Garmin hand-hold GPS which made in America to locate every measuring position. It can detect the GPS satellite signals which are continually sent by the 24 GPS’ satellites that belonged to the USA and measure the distances from at least three GPS satellites and the receiver, then tell us exactly where we are. The measurement precision is within less than 10 meters.

The investigation was performed in a grid net with 500m between every two lines and 100m between every two points. We changed to 20m between every two points, when the measured value varied evidently. In order to avoid the effect by the magnetic material such as cars and counties, a part of lines was changed. It reflected the $\Delta T$ area magnetic field and local abnormity clearly to indicate that the direction of the line is quite right and the net in the designation is very rational.

4 Data processing and the geological explanation

The measured data which were corrected by Normal field, Daily variation have been formatted by the method of the Kriging on the computer with the software of SURFER. At last, the distribution map of the measured points and the ichnography of Contours by $\Delta T$ were made(Guan et al., 2005).

In generally, sediment has weak magnetism and the evaporite has no magnetism basically. But the base was granite below, which has high magnetism. In the same words, the high-precision magnetic survey could be used to examine the little physical difference between the sediments and the evaporites, what's more important, it could be used to examine the variety of the base to provide basis for analyzing the Mineralization condition. There were two high value fields in generally reflected in the results in this district(Fig.1a). One is central belt, which trends northwest. The other one is in the northeast of the district. That made some good reference to region mineralization background analysis and mineralization prediction. The negative Magnetic abnormity or the weak positive Magnetic abnormity was advantageous to form sylvite. It's been discovered potassium-magnesium salt in the area A by predecessors. According to the above characteristics, the areas A, B and C are delineated as the favourable areas of Potassium mineralization (Fig.1b). It could be carried out synthetic interpretation in cooperation with other geophysical survey methods.

5 Conclusion

It obtained the high-precision magnetic data in the area of the Khammouane Potash Deposit and found out the preliminary macroscopic magnetic variation characteristic. The results of the magnetic survey made assistant use to prospect the areas A, B and C as the favourable areas of Potassium mineralization. It indicates that the efficient and fast exploration model can provide scientific basis for enterprises to prospect and explore new mineral resources.

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References