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Application of Gravitational Methods to Prospecting Salt (Potash) Rocks in the Kuqa Depression

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The Kuqa depression deposited thick rock salt, which has a lower density than surrounding rocks. When salt bodies form a certain scale, obvious negative gravity anomalies can be detected in the surface. Therefore, gravitational method can quickly obtain the shape, plane distribution of deep-seated salt bodies and overall tectonic morphology of the basin.

This gravitational prospecting at a scale of 1:25000 chose profile direction perpendicular to the general structural line direction, i.e., nearly NS, and measured 76 gravity profiles with an overall length of 2641.9 km. The operation quality and observation precision both meet the requirements of the specification.

The salt bodies in the horizon of interest have a deep burial depth and great thickness, and we should remove the effects of shallow geological bodies and deep basement when using gravitational data to evaluate these salt bodies. We selected a combined method of upward continuation with moving average to extract residual gravity anomalies after experimental comparison. Preferential upward continuation suppresses signal of shallow geological bodies, and more important, retains signal of deep geological bodies; moving average can effectively filter out large-scale basement field signal. The obtained residual anomalies can reflect the accurate middle frequency band of the low-density salt bodies and deep subsag. Six negative anomaly bodies were delineated in the Baicheng sag based on residual gravity anomaly (Fig. 1).

Drillhole data suggest that, the amplitude of negative residual gravity anomaly has a positive relationship with the thickness of sedimentary salt bodies (Table 1). The northern anomalies of G1, G2 and G3 have larger scale and amplitude than the southern 3 anomalies, and the anomaly G1 has the largest scale and amplitude, of which

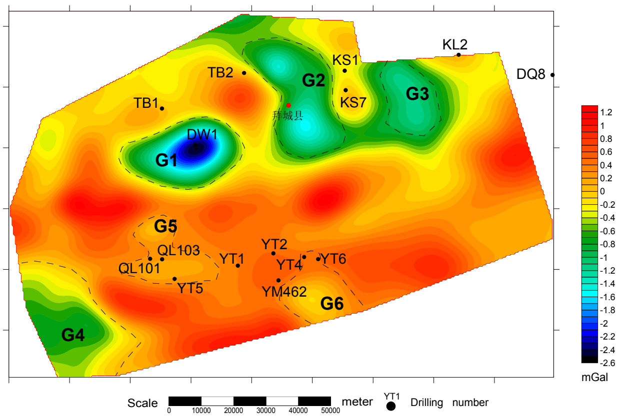

Fig. 1. Map showing residual gravity anomalies in the Kuqa depression.

the drill holes DW1, TB2 and KS7 penetrated 285-1358 m gypsum salt. The anomalies G5 and G6 are weak, and the drill holes QL101, YT 4 and YT 6 drill through 51-148 m gypsum salt. It is indicated that, the residual gravity anomalies correspond well with the distribution and scale of gypsum salt bodies, and thus inferred that, the negative gravity anomalies are caused by the Paleogene salt rock bodies.

We should mention that, there is a great diversity between the northern anomalies and southern anomalies. Therefore, the northern and southern blocks should be evaluated respectively when residual gravity anomalies are utilized to determine salt body thickness. The southern anomalies have small scale, but complete shape, which should attract much attention.

Gravitational exploration and interpretation in the Kuqa depression accurately extracted gravitational anomalies caused by horizons of interest-Paleogene. The 6 delineated negative anomaly bodies are caused by low-density salt rock. Residual gravity anomaly reflects variations of the Paleogene salt body thickness.

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Table 1 Relationship between thickness of gypsum salt rock penetrated by wells and gravitational anomalies

number	Gravitational anomoly	Well number	Thickness of gypsum salt rock（m）	Gravity anomaly amplitude / mGal
1	G1	DW1	1358	$-1.5\times10^{-5}ms^{-2}$ to $-6.5\times10^{-5}ms^{-2}$
2		TB1	1150	
3	G2	TB2	319	$-1.5\times10^{-5}ms^{-2}$ to $-3.7\times10^{-5}ms^{-2}$
4		KS7	641	
5	G3	KL2	285	$-1.5\times10^{-5}ms^{-2}$ to $-3.6\times10^{-5}ms^{-2}$
6	G5	QL101	148	$-0.9\times10^{-5}ms^{-2}$ to $-1.6\times10^{-5}ms^{-2}$
7		QL103	138	
8		YT5	143	
9		YT1	139	
10	G6	YT4	129	$-0.6\times10^{-5}ms^{-2}$ to $-0.7\times10^{-5}ms^{-2}$
11		YT2	53	
12		YT6	51	
13		YM462	60	

The deposition of potassium salt occurred in the late stage of saline lake evaporation, and therefore, prospecting sylvite must first find salt rocks. The next work should focus on distribution shape and depositional center of salt rock bodies by means of gravitational methods. Geochemical, geological and seismic methods should be integrated to identify potassium salt from anomaly bodies.

We can delineate the shape and depositional center of salt rock bodies in horizons of interest through gravity methods, and further carry out geophysical, geological and seismic survey in favorable potassium-bearing positions. This will greatly improve the efficiency of prospecting sedimentary potash resources.

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References

Yu Yixin, Tang Liangjie, Yang Wenjing, Chen Shuping, Peng Gengxin and Lei Ganglin, 2007. Salt-related structures and favorable traps in the Kuqa depression. *Geotectonica et Metallogenia*, 31(4): 404–411 (in Chinese with English abstract).

Yu Yixin, Tang Liangjie, Wang Qinghua, Yang Wenjing, Peng Gengxin and Lei Ganglin, 2005. Salt structures and forming models of hydrocarbon pools in the Kuqa depression. *Coal Geology & Exploration*, 33(6): 5–10 (in Chinese with English abstract).

Zeng Hualin, 2005. *Gravitational field and gravitational prospecting*. Beijing: Geological Publishing House (in Chinese).