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## Comprehensive Evaluation of the Lower Es3 Layer Shale in Bonan Depression

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### 1 Introduction

With the development of technology continues to improve, a number of domestic and foreign basin began commercial shale oil and gas exploration [Bustin R M, 2005; Ronald J H, et al; Guan Deshi, et al, 1995]. Bonan depression of Jiyang sag has 9 wells obtained industrial oil flow in lower Es3 layer shale. And L42 well has been produced crude oil for 13465 tons. That shows good exploration prospects of shale oil and gas in Bonan depression. But because the study of the shale oil and gas exploration is district started late and analysis data are lack, therefore there has not conducted in-depth evaluation on shale. In 2010, about 9000 piece of shale cores of L69 are analysis, which provides a foundation for the comprehensive evaluation of shale.

### 2 Comprehensive Evaluation of Shale

In foreign countries, the main evaluation parameters of shale oil source rock including the total organic carbon content, thermal maturity and thickness of dark shale, etc [Martineau D F, 2007]. In Bonan depression, the total organic carbon content, the type of organic matter, organic matter evolution degree and effective thickness of shale are studied.

From the geochemical analysis results can be seen (Table 1). In Lower Es3 Layer of Bonan depression, the TOC content of Shale is 0.74%-9.32%. The organic matter type is mainly type I, which is high-quality lacustrine source rock. The buried depth of shale organic matter is between 2500m and 3500m, and the evolution degree value of it is 0.58-0.91%, which is in a stage of hydrocarbon generation. The lowest limit effective thickness of shale in Jiyang sag is 50m [Wang Yongshi, et al, 2013.]. The thickness of shale in Bonan depression is 0-680m (Fig. 1), and the thickness which large than 50m is about 400km<sup>2</sup>.

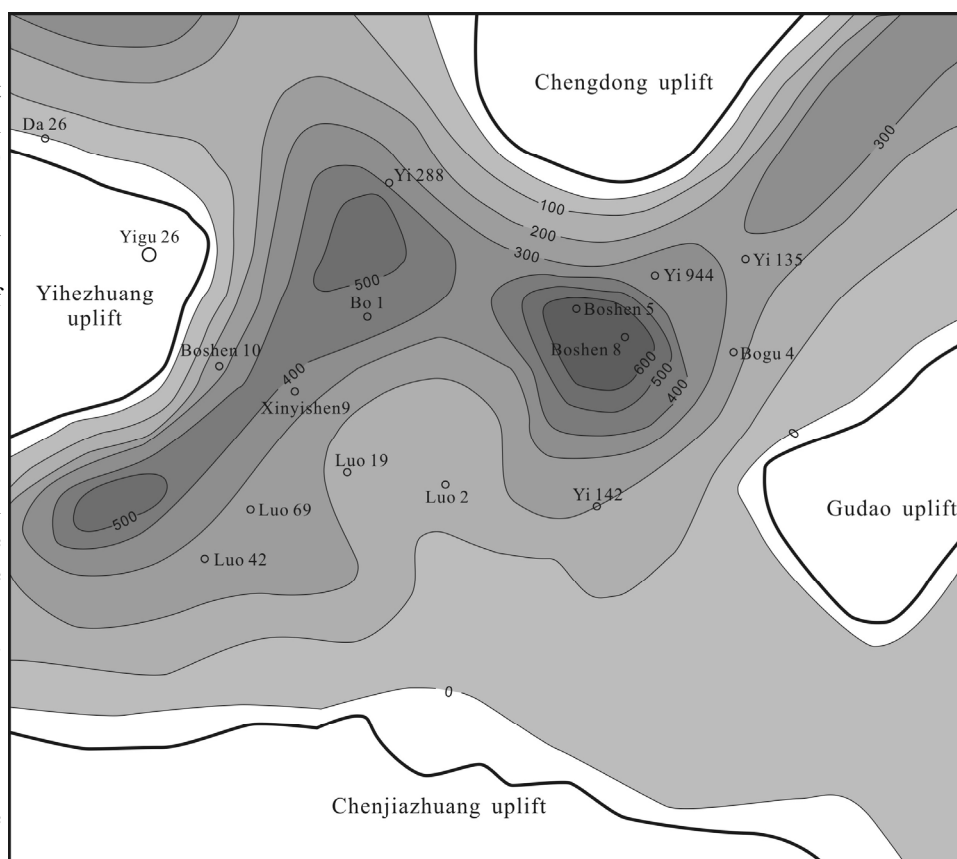


Fig. 1. the thickness of the lower Es3 layer shale in Bonan depression

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**Table 1 Geochemical analysis of the lower Es3 layer shale in Bonan depression**

Well	TOC (%)	Hydrocarbon Potential Generation (mg/g)	Components of chloroform bitumen "A" (%)	Ro (%)	Organic matter type	Thickness (m)	Comprehensive evaluation
Xinyishen 9	0.74~3.02	15.13	\	\	I	360	High quality
Luo 67	1.12~4.09	\	\	0.58~0.83	I	290	High quality
Luo 69	0.98~9.32	6.04~82.65	0.25~2.14	0.70~0.91	I	275	High quality

### 3 Conclusions

Through the comprehensive evaluation, the lower Es3 layer shale in Bonan Depression with high abundance of organic matter, and the organic matter type is type I, which is in high evolution degree. The distribution range of the effective thickness of shale is large. Bonan Depression is a high quality area for shale oil and gas exploration.

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