

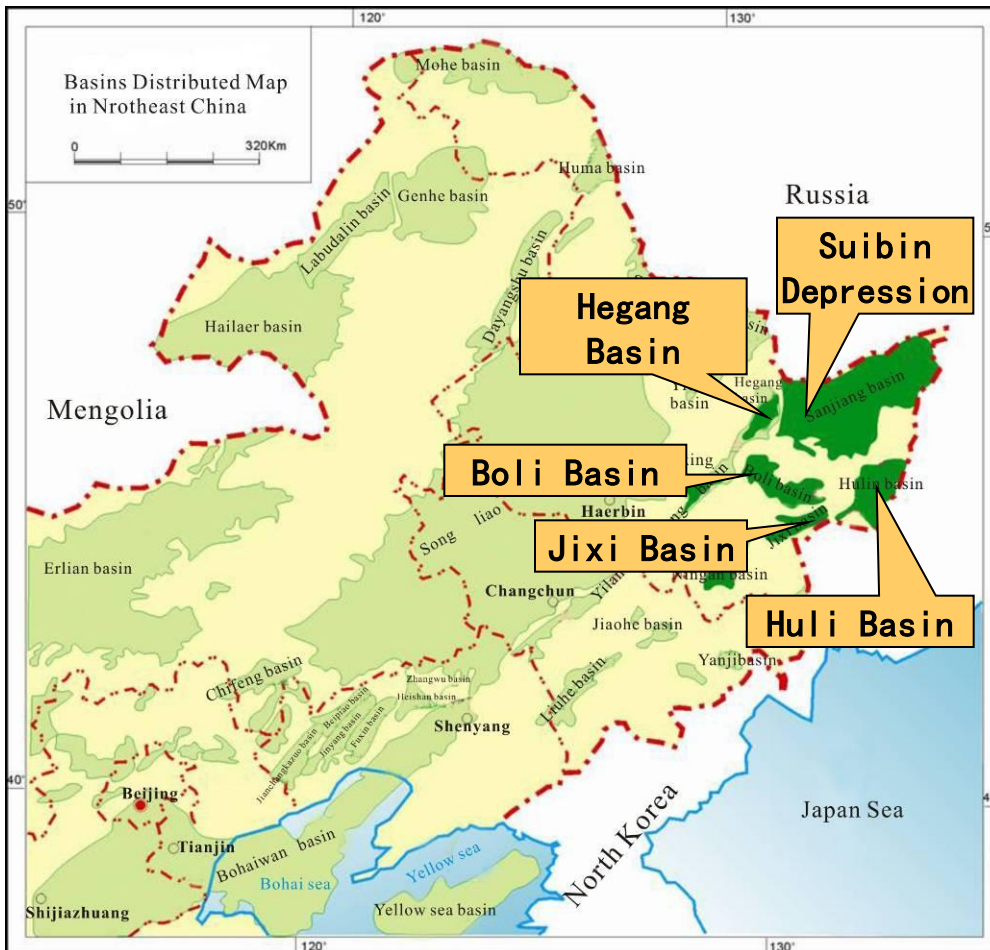
# Potential Analysis of Coal-bed Methane in Sanjiang Basins of Eastern Heilongjiang Province

**Bin Sun**

**Research Institute of Petroleum  
Exploration and Development – Langfang**

- **Geological Background**
- **Geological Features of CBM**
- **Target Area for CBM Exploration**
- **Conclusion**

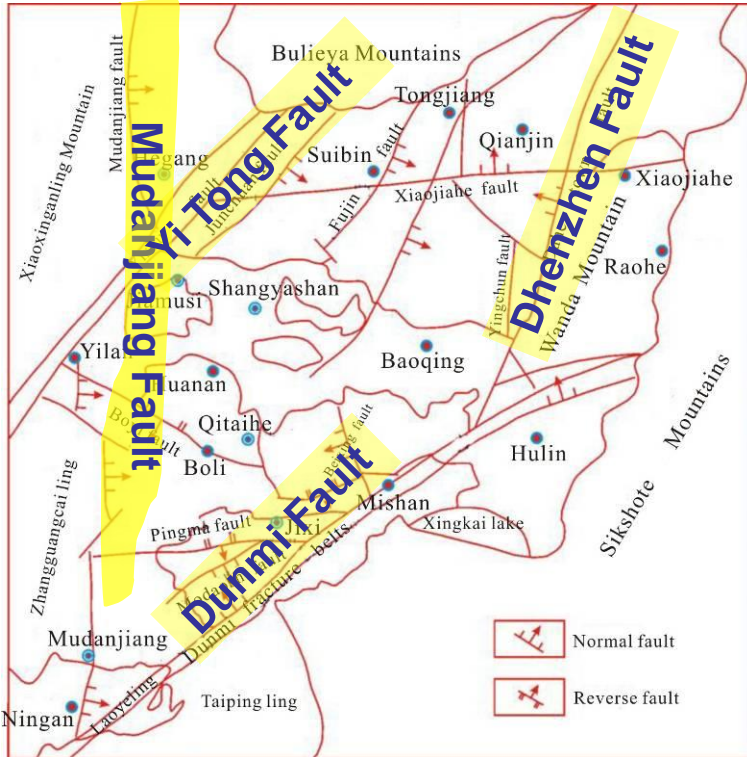
## 1. Location



➤ Sanjiang Basins locating Northeastern China consists of the following five gas-bearing blocks, Jixi Basin, Boli Basin, Hegang Basin, Hulin Basin and Suibin Depression with 140~220 km wide and 460 km long. The Coal-bed Methane Resource is abundant within the 15000km<sup>2</sup> gas-bearing areas.

**Basin Distribution Map in Northeastern China**

## 2. Structural Features



Tectonic Evaluation Processes:

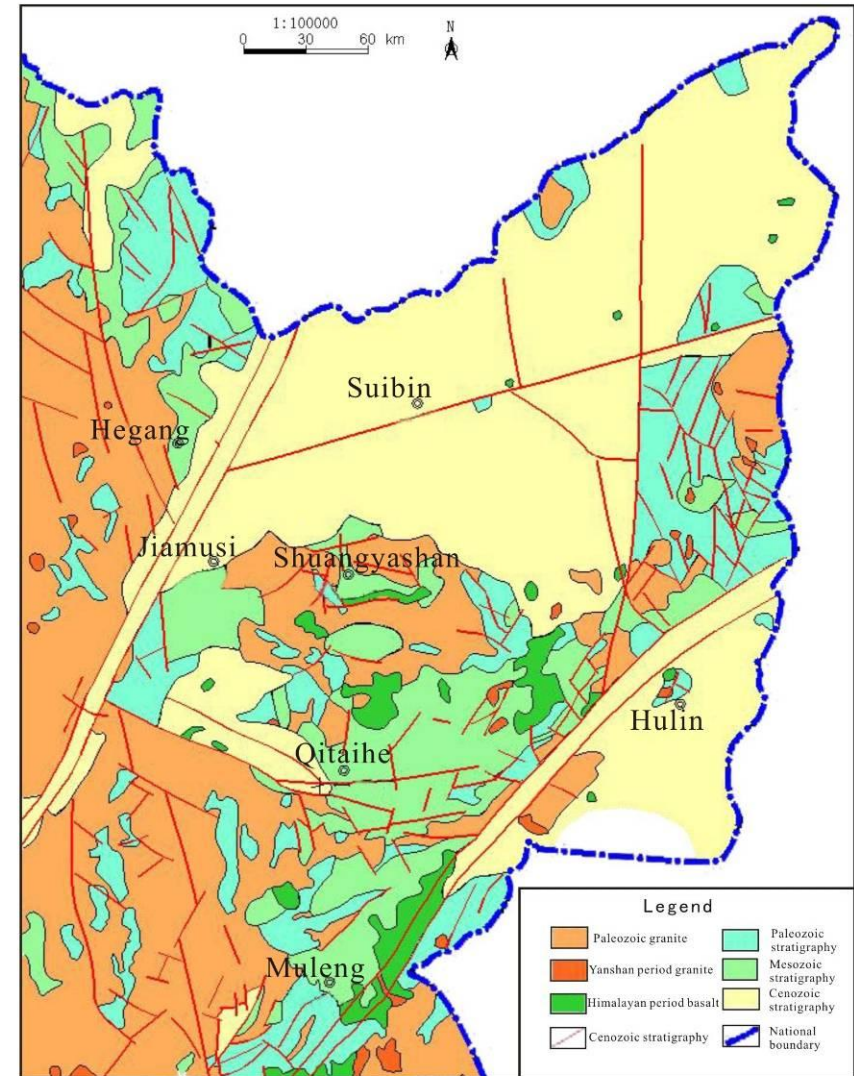
- ① **Primary Extensional** : Early Jurassic - thin coal-beds, bad continuity, small distribution range, regional recoverable.
- ② **Further Extensional** : Early Cretaceous - thick coal-beds, great continuity and resource potential;
- ③ **Wilting period of Lacustrine Basin**: Tertiary – great resource potential and accumulated coal-beds thickness of Hu1 Well is estimated up to 117m.

➤ Faults are well-developed in the research area, especially normal faults trending towards NE and S.

➤ Four Major Faults :Mudanjiang Fault, Yishu Fault, Dunmi Fault and Dazhen Fault.

## 3. Regional Stratum

- The research area consist of the following stratum, from oldest to the youngest, Archean, Proterozoic, Palaeozoic, Mesozoic and Cenozoic.
- Strata of Cretaceous are mainly exposed in Boli Basin, Jixi Basin and Hegang Basin; The outcrop of Tertiary and Quaternary Strata are dominantly in Suibin Depression, southern Hulin Basin and Western Boli Basin.



## 4. Main Coal Bed

Chengzihe Formation and Mulin Formation of Lower Cretaceous are main coal-beds in Sanjiang Basin Group.

➤ Chengzihe Formation:

Well-developed coal-beds, great resource potential, 20~70 coal-bearing units.

➤ Mulinghe Formation:

- 9 recoverable coal-beds (3.7~7.8m thick) in Qitaihe
- 2 coal-bearing units in Jixi Basin
- None recoverable units in Shuangyashan;
- 1~5 coal-bearing units in Hegang Basin.

### Stratum Sequences of Jixi Basin

System	Series	Group	Formation	Thickness	Remarks
Quaternary			Alluvium	47~86	
Neogene	Pliocene	Jidong	Yellowish mudstone	6~33	
			Jidong Basalt	<10~149	
	Miocene		Daqingshan	102~300	Coal-bed
	Paleogene		Oligocene	Jilin Basalt	<20~300
Eocene		Yongqing	190~1250	Coal-bed	
Cretaceous	Upper		Hailang	0~500	
	Lower	Yeshan	Houshigou	>1500	
			Dongshan	400	Volcaniclastic rock
	Jixi	Muling	1050	Coal-bed	
		Chengzihe	1400	Coal-bed	
Didao		0~360	Volcaniclastic rock		
Permian	Upper		Hongshan	>2248	
	Lower		Erlongshan		
Carboniferous	Upper		Zhenzishan	631~1731	
			Guangqing		
Devonian	Middle		Heitai	1105	

## 1. coal-beds Thickness

- Chengzihe Formation: 20~70m coal-beds, accumulated thickness is estimated up to 80m; Recoverable coal-beds in Hegang Basin, Suibin Depression are around 1.85~20.75m thick.
- Mulinghe Formation: mostly thin coal-beds; 9 recoverable coal-beds are 3.7~7.8m thick.



## 2. Metamorphism Features of Coal

- The coal sample is vitrinite-rich (77.2%~90.2%) and liptinite - poor (<10% ) with ash of 20%~30%. The resource rock is high ash and low sulfur coal (<5%).
- Ro (Vitrinite Reflectance ) is around 0.65~2.74% averaging 0.98%.
- Coals have different degrees of degeneration, the main coal ranks have gas coal, fat coal and coking coal.



## 3. Porosity and Permeability

■ The Range of Porosity:

1%~7%; Average Porosity:

3~4%.

■ Ranking of Average Porosity:

Jixi> Hulin> Suibin> Boli>

Hegang.

■ The Range of Permeability:

0.04~20.3mD, Average

Permeability: 2~3mD.

Ranking of Average Permeability:

Jixi> Huli> Suibin> Hegang> Boli.

## 6. Gas-bearing Features

Basin	Geological Background			Gas-bearing Features		
	Coal-beds	Number of Coal-beds	Coal Rank	Gas Capacity m <sup>3</sup> /t	Methane Concentration %	Gas saturation %
Hegang	K1	3-30	CY-QM	$\frac{2.47-23.26}{7.7}$	<78	50
Jixi	K1	1-10, 20-50	QM-JM	$\frac{2.86-30}{8.4}$	89	51
Suibin	K1	5-30	CY-QM	$\frac{3.8-10.8}{6.89}$	87	47
Boli	K1	45-71, 87-99	QM-WY	$\frac{3.2-10.2}{6.7}$	90	37

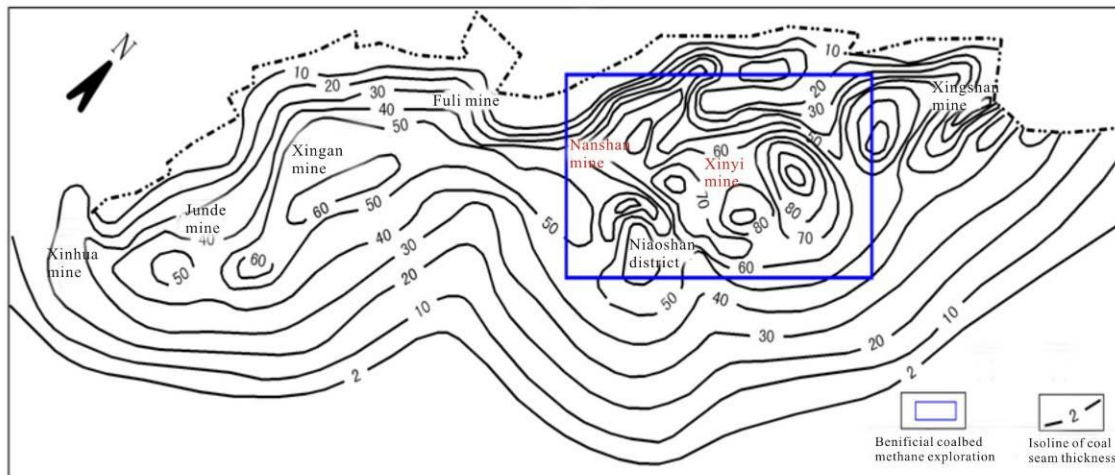
- The Gas Content: 2.47~30m<sup>3</sup>/t.
- Average methane concentration >80%
- Gas Saturation: 37%-51%

# Target Area for CBM Exploration

## 1. Resource Assessment of Hegang Basin

- Nanshan-Xinyi Mine is favorable exploration target area for CBM.

Isopach Map of Coal-beds in Hegang Basin



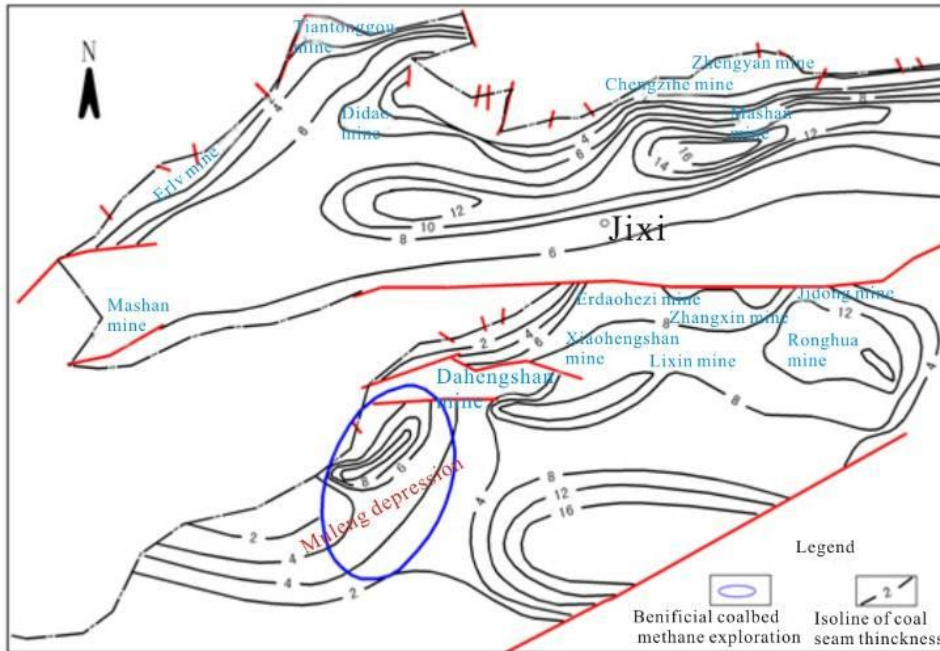
### Favorable Conditions:

- Accumulated Coal beds thickness of 20m, up to 3m thick per single layer.
- Coal ranks are primarily fat and coking coal, indicating good gas generating ability.
- Gas Content: 4~8m<sup>3</sup>/t
- 85% consists of high-gas coal mines, with relative gas emission of 12m<sup>3</sup>/t or more, up to 65.6m<sup>3</sup>/t
- Organic Carbon content of 83~92%; average vitrinite > 70%.
- The upper section of coal-beds consists several cycles of mudstone intercalated with tuff layers, providing good cover.

## 2. Resource Assessment of Jixi Basin

- Muling Depression in Jixi Basin is favorable exploration target for CBM.

### Isopach Map of Coal-beds in Jixi Basin



Favorable Conditions:

- Accumulated Coal beds thickness is estimated up 20m approximately, the thickest coal bed is 3m.
- Coking Coal and fat coal are beneficial for gas generating.
- Gas Content: 4~8m<sup>3</sup>/t
- Wells with high gas capacity take 85%, Average Gas Emission: 12m<sup>3</sup>/t, Maximum Gas Emission: 65.6m<sup>3</sup>/t
- Organic Carbon accounting for 83~92%; Vitrinite > 70%.
- The upper section of coal-beds consists several cycles of mudstone intercalated with volcanic tuff showing good sealing capacity.

- Chengzihe Formation and Muling Formation in early Cretaceous are the main coal-beds in Sanjiang Basin Group. Coal rank are primarily fat coking coal indicating good gas generating ability.
- Mudstone and volcanic tuff overlay on the coal-beds showing good sealing capacity;
- Based on the analysis above, Sanjiang Basin Group shows good exploration prospect. Nanshan~xinyi Mine in Hegang Basin and Muling Depression in Jixi Basin are the most favorable exploration target for exploring coal-beds methane in the future.

Thanks a lot!