



**2009 Asia Pacific Coalbed Methane Symposium &
2009 China Coalbed Methane Symposium**

中国煤层气地面井开发技术模式

**Technological Models of Coalbed
Methane Development by surface wells
in China**

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and Technology**

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概述

2 the technological model of In-situ coalbed methane development by surface wells

原位煤层气地面井开发技术模式

3 the technological model of pressure relief coalbed methane development by surface wells

卸压煤层气井地面井开发技术模式

4 the integrated technological model of In-situ & pressure relief coalbed methane development by surface wells

原位-卸压煤层气地面井一体化开发技术模式

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结论



1 Introduction

The development process

In 1970's

- Pre-mining coalbed gas extraction by surface wells

In early 1990's

- Gob gas drainage by surface wells
- In-situ coalbed methane drainage by surface wells

In early 2000's

- Pressure relief coalbed methane drainage of distant protected seam by surface wells
- In-situ coalbed methane drainage by horizontal multi-lateral wells

In late 2000's

- In-situ coalbed methane drainage by directional butted wells
- In-situ & pressure relief coalbed methane drainage by one well



1 Introduction

Division of the technological models

- **The technological model of In-situ coalbed methane drainage by surface wells**

- vertical well with entire strata casing completion and perforating and fracturing
 - horizontal multi-lateral well
 - directional butted well
-
-

- **The technological model of pressure relief coalbed methane drainage by surface wells**

- gob vertical surface well
 - distant protected seam vertical surface well
-
-

- **The integrated technological model of In-situ & pressure relief coalbed methane drainage by surface wells**



1 Introduction

Selection of the technological models

- **the geological adaptability rule**

The technological model application largely depends on the complexity and diversity of coal and coalbed methane geological conditions in China

- **the comprehensive benefit rule**

The technological model application should be favorite to both coal and coalbed methane developments, as their interaction and coalbed methane comprehensive benefits, coal production safety, natural gas utilization and air environment protection, ought to draw much attention, especially in coal mining areas

- **the risk minimization rule**

The technological model application can make the investment risk minimized, most importantly, it is mature and economical

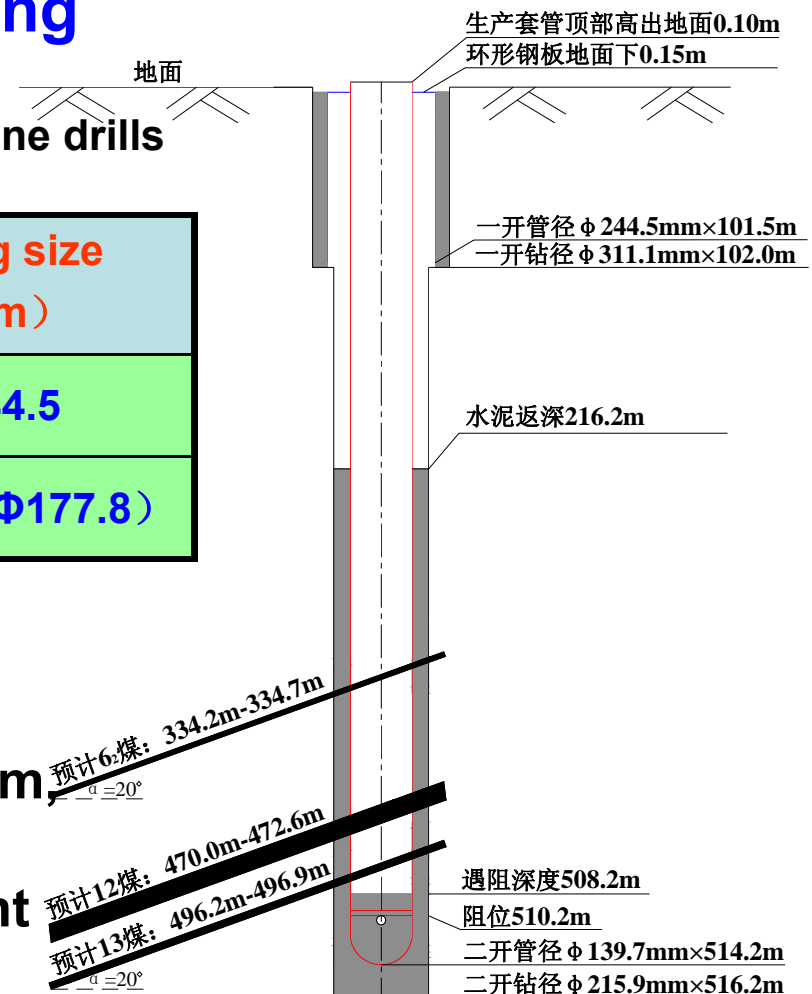


2 The technological model of In-situ coalbed methane development by surface wells

Vertical well with entire strata casing completion and perforating and fracturing

Borehole structure meters of normal coalbed methane drills

drilling procedure	bit size (mm)	casing type	casing size (mm)
first opening	Φ311.1	surface casing	Φ244.5
second opening	Φ215.9	production casing	Φ139.7 (Φ177.8)

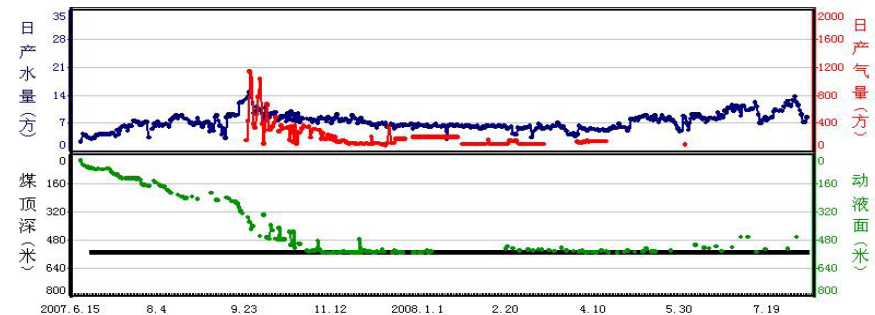
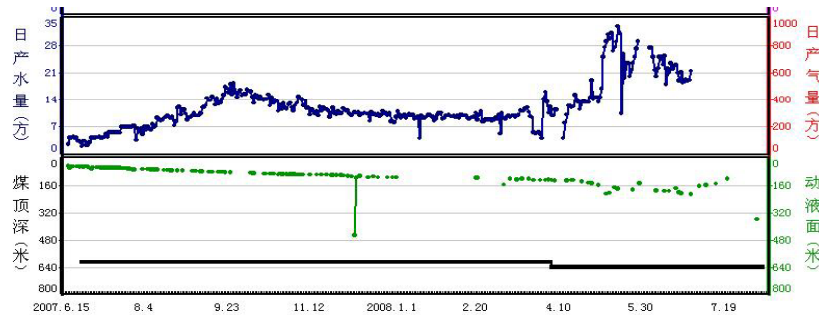


Proper geological conditions: simple to more complex structure, single to multiple coal seams, thin to thick seam, medium-high coal rank, holonomic coal texture, medium-high gas content and medium-high permeability

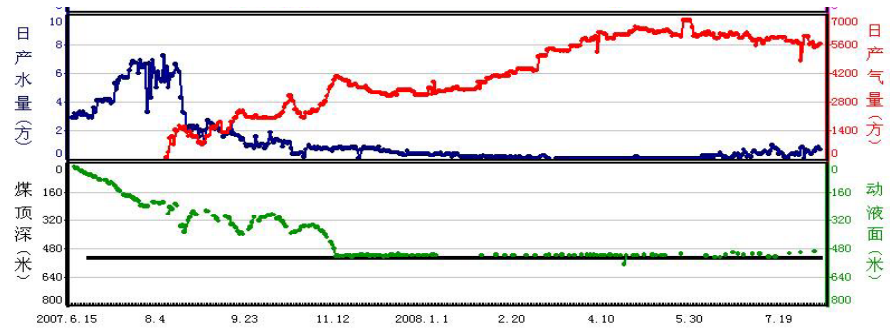
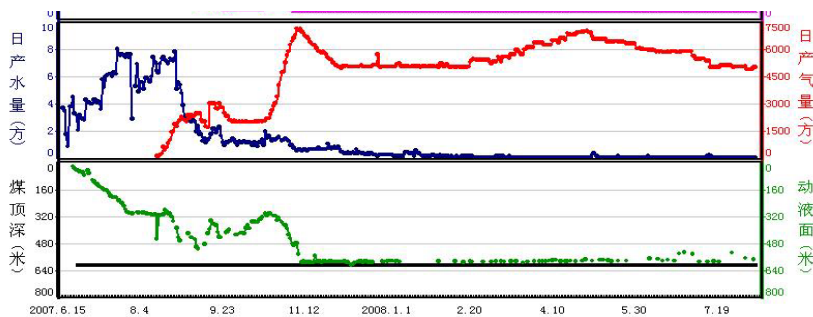


2 The technological model of In-situ coalbed methane development by surface wells

Vertical well with entire strata casing completion and perforating and fracturing



Illustrations of low production wells in Qinshui basin

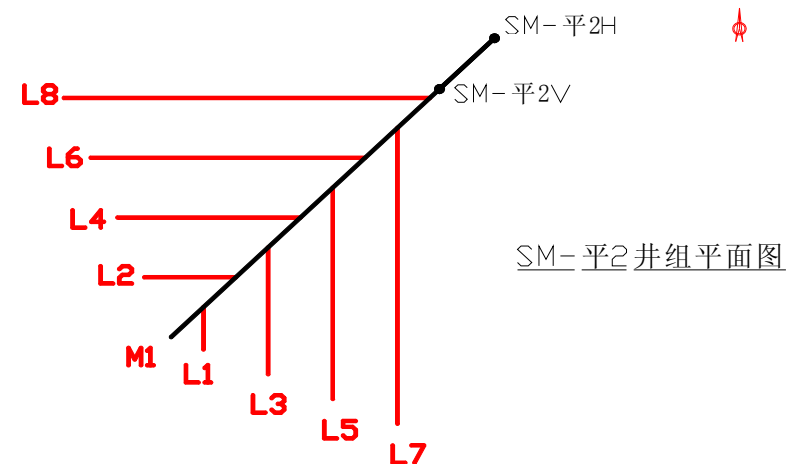
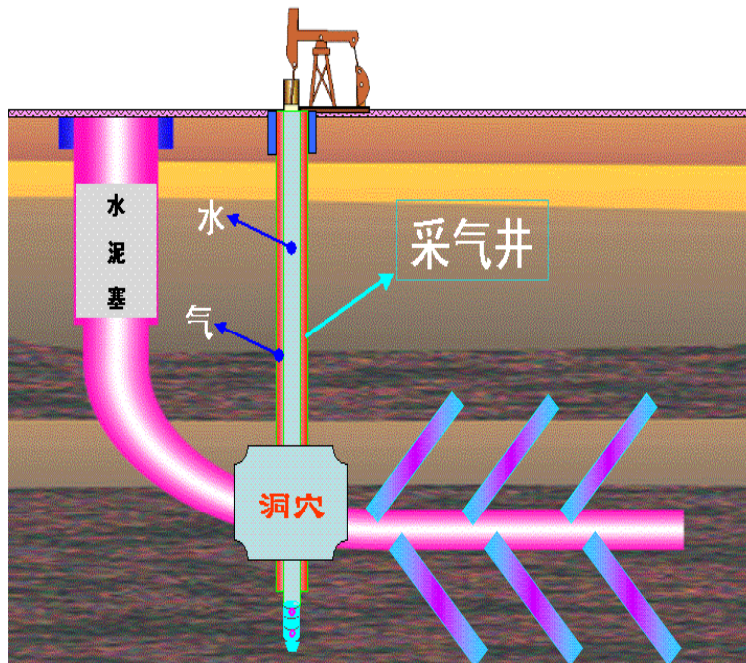


Illustrations of high production wells in Qinshui basin



2 The technological model of In-situ coalbed methane development by surface wells

Horizontal multi-lateral well



Proper geological conditions: simple and well-controlled structure, single coal seam, thick and steady seam, holonomic coal texture, medium-high gas content, low-medium permeability, higher coal rank and great coal mechanical strength



2 The technological model of In-situ coalbed methane development by surface wells

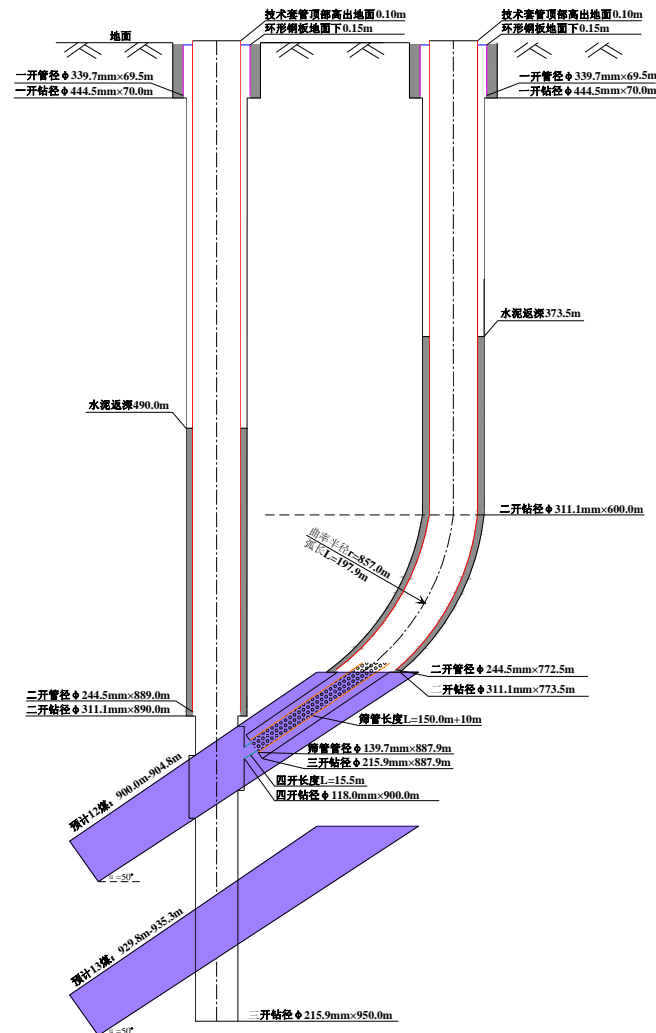
Directional butted well

Butt of horizontal well and vertical well

Butt of slant well and vertical well

Proper geological conditions:

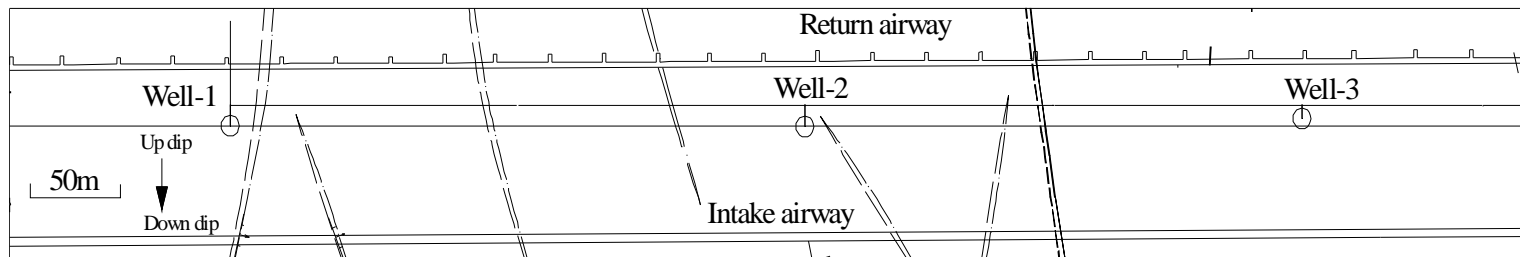
relatively simple and well-controlled structure, horizontal or inclined seams, single or multiple coal seams, relatively thick and steady seam, holonomic coal texture, medium-high gas content, low-medium permeability, higher coal rank and great coal mechanical strength



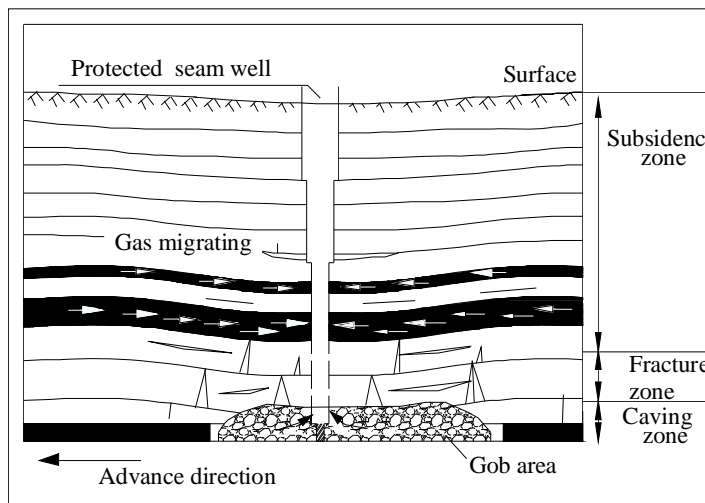


3 The technological model of pressure relief coalbed methane development by surface wells

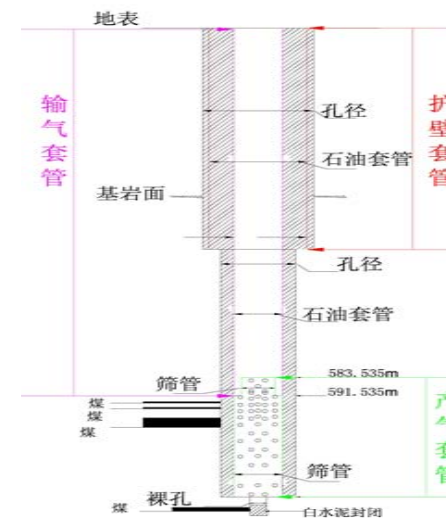
Distant protected seam vertical surface well



Locations of surface vertical wells for pressure relief CBM drainage



Pressure relief CBM migration and surface vertical wells drainage

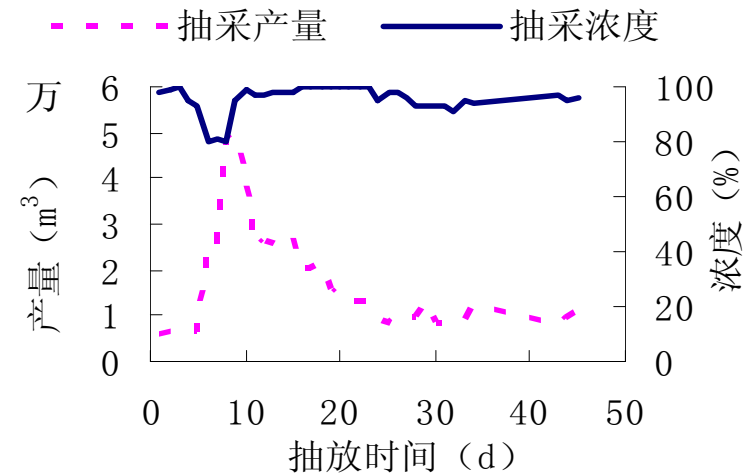
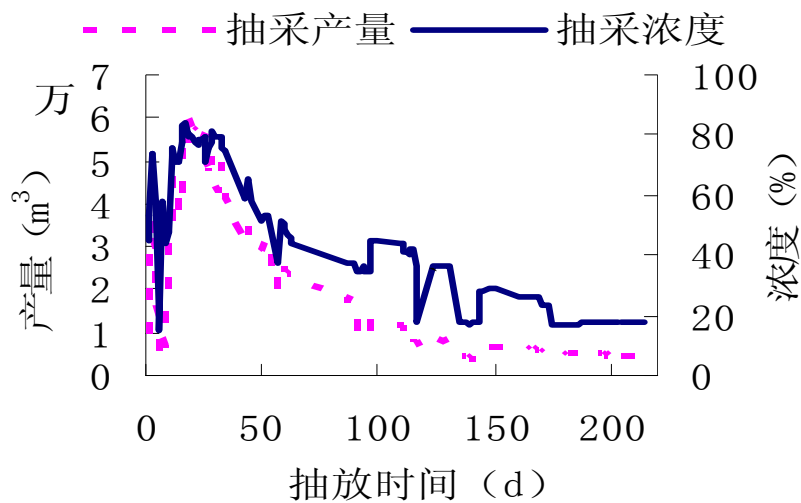


Sketch of structure of the surface vertical well for the protected seam pressure relief CBM drainage



3 The technological model of pressure relief coalbed methane development by surface wells

Distant protected seam vertical surface well



Illustrations of high production wells in Huainan

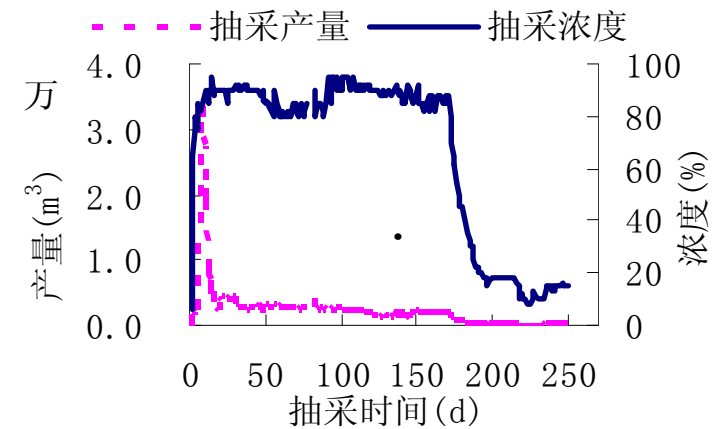
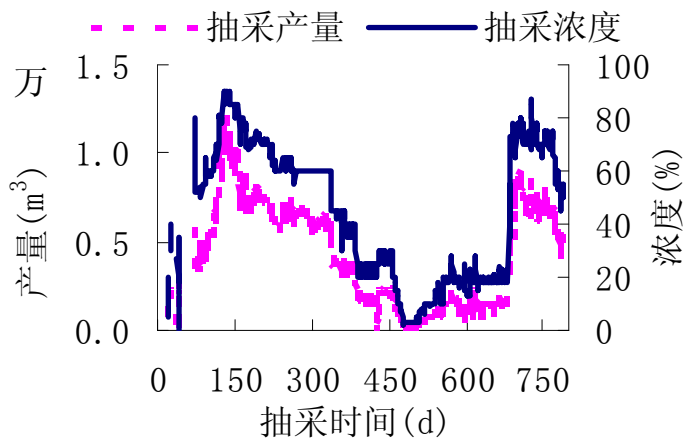


Illustration of low production wells in Huainan



3 The technological model of pressure relief coalbed methane development by surface wells

Distant protected seam vertical surface well

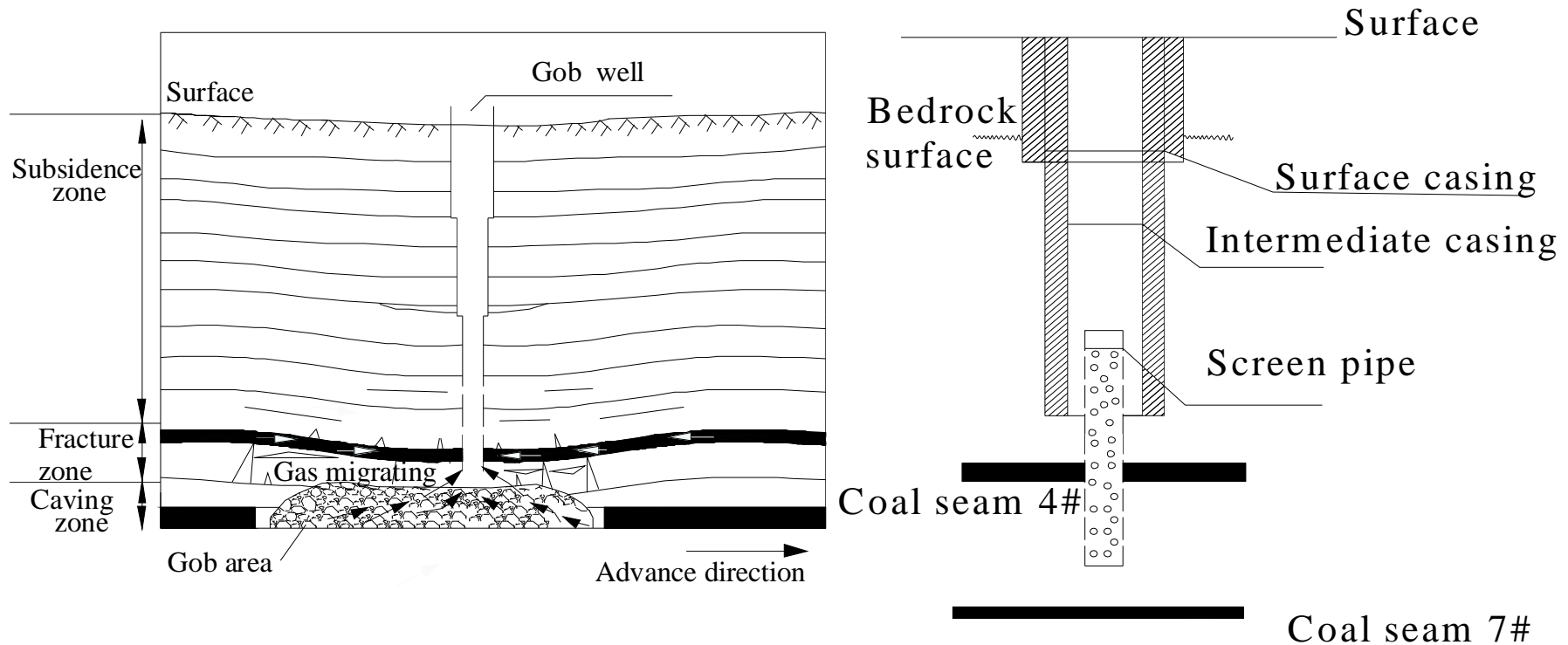
Proper geological conditions:

- 1) In productive mining areas;**
- 2) high gas content and low permeability;**
- 3) At least two coal seam targets, especially the upper of sheared coal;**
- 4) medium-thick seams, proper seams interval;**
- 5) Coal and coalbed methane co-extraction, for the protected seam, coalbed methane drainage prior to coal mining**



3 The technological model of pressure relief coalbed methane development by surface wells

Gob vertical surface well



Pressure relief CBM migration and surface vertical wells drainage

Sketch of structure of the surface vertical well for the protected seam pressure relief CBM drainage



3 The technological model of pressure relief coalbed methane development by surface wells

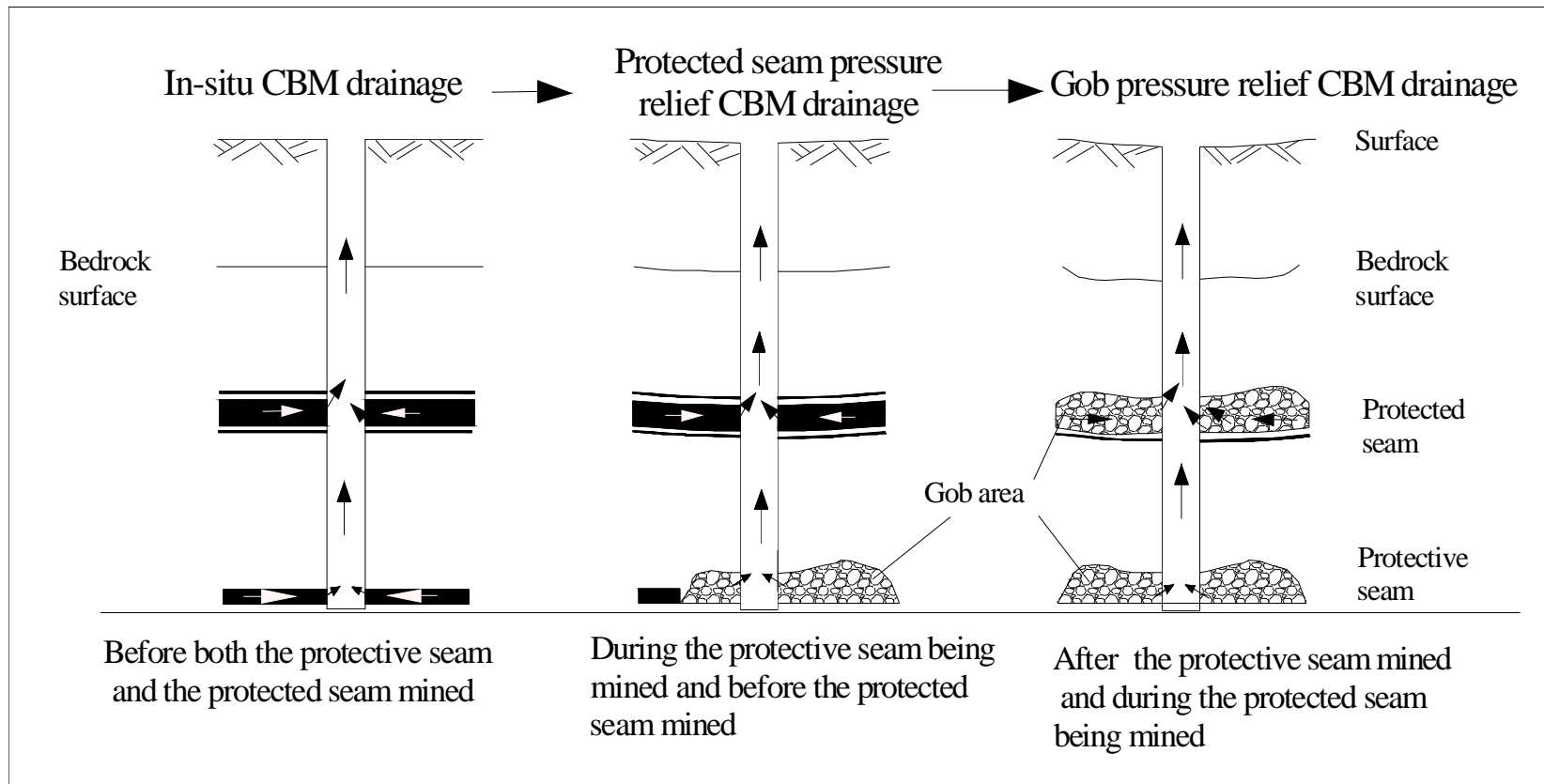
Gob vertical surface well

Proper geological conditions:

- 1) In productive mining areas or abandoned mining areas;**
- 2) high gas content and low permeability;**
- 3) Single or multiple coal seams, especially the sheared coals;**
- 4) thin-thick seams, especially coal groups;**
- 5) Coal and coalbed methane co-extraction, coal mining prior to coalbed methane drainage or at the same time.**



4 the integrated technological model of In-situ & pressure relief coalbed methane development by surface wells





4 the integrated technological model of In-situ & pressure relief coalbed methane development by surface wells

Proper geological conditions:

- 1) In the deep of productive mining areas or planned mining areas;**
- 2) high gas content and low permeability;**
- 3) At least two coal seam targets, especially the lower's texture holonomic;**
- 4) medium-thick seam, proper seams interval;**
- 5) Coal and coalbed methane co-extraction**



5 conclusions

- 1) **Diversity of technological models of coalbed methane drainage by surface wells are necessary, of which not the advanced but the one adapting and efficient to the actual situation is the best.**
- 2) **Selection of the models must comply to three rules, the geological adaptability rule , the comprehensive benefit rule and the risk minimization rule.**
- 3) **As to the technological mode of In-situ coalbed methane development, the vertical surface well is facing with challenge of lower permeability reservoirs in general, horizontal multi-lateral well application is also limited, but directional butted well deserves to draw more attention.**
- 4) **As to the technological model of pressure relief coalbed methane development, the distant protected seam vertical surface well will be applied broadly with its own maturation, and the gob vertical surface well has some potentials.**
- 5) **the integrated technological model of in-situ & pressure relief coalbed methane development by surface wells is expected to draw more and more attention.**

Thank you!

