Mine Water Issues in China

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Why do I put forward this topic?

- "Contemporary reviews of mine water studies in Europe" (Christian & Rob 2005)
- WISA/IMWA (South Africa, 2008) "mine water and the environment"
- "Different situations, different mine water concerns in China" (China delegates in South Africa, 2008)

What shall I do?

- Introduce the unique geologic & hydrogeologic conditions of coalmines in China
- Discuss the key coal mine water issues in China

China's coal fields

Hydrogeologic conditions

China's coal fields

Coal fields and Geologic conditions of North-China coal fields

Hydrogeologic conditions

Types of Mine water issues

Coal accumulation provinces in China

Salvage from a flooded mine

A coal mine in Northwest China

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Hydrogeologic conditions of North China coal fields

Upper

Shi-he-zi

Triassic

Tertiary

Quaternary

Permian

Carboniferous

Ordovician

Cambrian

Porous aquifers

Fractured sandstone aquifers

Thin karst aquifers

Regional karst aquifers

Mine water issues in North China coal fields

- preventing mine water-inrush (Since the 1990s)

- Types of mine water-inrush:
  - Water-inrush from the Quaternary porous aquifers
  - Water-inrush from overlying fractured sandstone aquifers
  - Water-inrush from the underlying Taiyuan karst aquifers
  - Water-inrush from underlying Ordovician-Cambrian karst aquifers (through faults and sinkholes)
  - Water-inrush from goaf water

Mine water issues in North China coal fields

- Catastrophic hazards
  - Ordovician-Cambrian karst water-inrush
    - Ordovician karst water inrush & flooding through a sink-hole, Fan-ge-zhuang Mine, Hebei, in 1983 (Q=2053 m³/min)

- Mine water-inrush accidents mostly be controlled (by the end of 1990s)

Mine water drainage

Updated research on North-China issues

- the top of Ordovician strata partially-fully filled by calcite, pyrite and clay can serve as relative aquifuge
- successful underground geophysical exploration techniques
- floor-grouting techniques to consolidate weak floor, faults, pit-holes

“Study on the basic theory about the mechanism of water inrushing of coal mines and its prevention” ("973 Programme")

Updated research on North-China issues

- the top of Ordovician strata partially-fully filled by calcite, pyrite and clay can serve as relative aquifuge
- successful underground geophysical exploration techniques
- floor-grouting techniques to consolidate weak floor, faults, pit-holes

Methodologies of karst water prevention

Surface grouting project

Hydrogeologic conditions in Northwest China

Hydrogeologic map of arid region (Northwest China)

Hydrogeologic map of China
Coal fields and conditions in Northwest China

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<th>Form-</th>
<th>Column</th>
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Issues in Northwest China

Schematic map of water bursting-inrush (the Jurassic coal seam covered by thick base Mesozoic rock)

Schematic map of water and sand inrush (the Jurassic coal seam covered by thin base Mesozoic rock)

Updated research on Northwest China issues

- Institutional regulations (To Protect Surface and groundwater Water sources)
- Administrative policies (water resource management)
  - Technical measures
    - Delineate water protection areas;
    - weak aquifer water pooling
    - goaf water pooling;
    - Backfilling techniques;

Mine water issues in South china

- Regional karst aquifers

Other Environmental Problems

- Surface subsidence destroy land & buildings and vast village transfer expence;
- Land damage

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<th>Areas of surface subsidence</th>
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Other Environmental Problems

- Surface subsidence destroy land & buildings and vast village transfer expence;
- Land damage

- Spoil heaps (more than 1600) take up land and pollute water and air

<table>
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<tr>
<th>Year</th>
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<tr>
<td>2005</td>
<td>4200x10^6km^2 26%</td>
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<tr>
<td>2010</td>
<td>5000x10^6km^2 70%</td>
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Conclusions

- The mine water issues in China are different from those in the 1990s.
- The coalmines in North-China will have to confront challenge of higher Ordovician water pressure; the main solution is to use the top Ordovician as relative aquifuge.
- The key issues in Northwest China are to protect the water value resources and the vulnerable environment; water protection zone delineating, weak aquifer water pooling, goaf water pooling, goaf filling, etc have been used.
- Those coalmines in South China are always cautious against the danger from overlying and underlying Permian karst aquifers.

Thank you.

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