2000

Mining Geology of Coals in Western Kentucky

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**Mining Geology of Coals in Western Kentucky**

Stephen F. Greb and David A. Williams

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**Introduction**

The western Kentucky coal field is one of the most heavily mined coal regions in the United States. Coals from this field have been extensively mined for over a century, and the mining industry continues to be a significant economic contributor to the region. The field is known for itshighly stratified coal seams, which are often associated with a variety of mining obstacles and phenomena.

**Figure 1.** Major coal beds and stratigraphy of the Western Kentucky Coal Field. From Greb and others (1998).

- **Table 1.** Lithology and Coal Beds (No. 10).
- **Table 2.** Additional mining obstacles that can affect all coal beds and/or area (11), featuring (116) in particular.

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**Formations**

<table>
<thead>
<tr>
<th>Formation</th>
<th>Coal Beds (No. 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboniferous</td>
<td></td>
</tr>
<tr>
<td>Pennsylvanian</td>
<td></td>
</tr>
<tr>
<td>Devonian</td>
<td></td>
</tr>
</tbody>
</table>

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**Figure 2.** Major tectonic structures of the Western Kentucky Coal Field, to the south of the Marcellus. Sometimes (12) caused by the pillars. Numerous methods are available to assess lateral and vertical strain, including studying influence of nodal points and nodal hydrofracturing (Gunter, 1976) and biaxial detectors (Gard, 1996).

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**Figure 3.** Slip failures in the western Kentucky coal field. These failures can occur on a variety of scales, including large-scale failures in the Coal Measures and small-scale failures in the Mercia Mudstone.

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**Figure 4.** Rock falls related to lateral-stress fields are affected by bedding orientation.

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**Low-Cover Areas**

When coal is mined within 100–150 ft of the surface, it is considered a low-cover area. Low-cover areas often occur beneath alluvial valleys, where bedrock thickness is diminished. These areas are typically associated with surface mining activities. Low-cover areas are prone to instability, making careful planning and analysis necessary to ensure worker safety. Water infiltration beneath low cover, especially beneath alluvial valleys, also increases permeability.

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**Figure 5.** Sections through a funnel-shaped coal mine that has created a fault into an underground coal bed.

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**Lateral-Stress Field**

In the Illinois Basin, stress within the coal field is complex and variable. Stress patterns are influenced by tectonic activity, sediment loading, and regional compressive stress fields. In the western Kentucky coal field, tectonic activity has played a significant role in the development of stress patterns.

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**Figure 6.** Coal bed instability in an underground coal mine, showing the effects of lateral-stress fields on coal bed integrity.

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**Faults and Fractures**

Faults and fractures are common in the western Kentucky coal field, and they play a significant role in the development of mining barriers. These features can affect mining operations by causing instability, leading to increased mining costs and decreased productivity. Faults and fractures can also act as pathways for fluids (water and gas) and natural gas. Some may be associated with increased mineralization and sulfur content in adjacent coals.

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**Figure 7.** Generalized Baker coal bed geology.

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**Additional mining obstacles that can affect all coal beds and/or area**

- **Faults and Fractures**
- **Jointing**
- **Sheeted Sandstone**
- **Clay Veins**
- **Lithology**
- **Water Infiltration**
- **Seam Discontinuities**
- **Rooting and Fireclays**

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**Figure 8.** Fall of thick fireclay beneath a thin coal rider at depth. Unmapped faults are still sometimes encountered during mining. Because there are numerous faults in western Kentucky, many blocks of coal are offset by faults. Faults can be quite numerous in the field, and they can affect the mining operations by causing instability and increasing mining costs.

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**Figure 9.** Fall of fireclay beneath the top of coal, showing the effects of lateral-stress fields on coal bed integrity.

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**Conclusion**

In conclusion, mining geology in the western Kentucky coal field is complex and variable, with a variety of mining obstacles and phenomena affecting mining operations. Understanding these factors is crucial for ensuring worker safety, minimizing costs, and maximizing productivity. Continued research is needed to better understand the geology of the western Kentucky coal field, and to develop innovative strategies for addressing these challenges.

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**Acknowledgements**

We wish to thank the mine personnel and inspectors who provided information and assistance. Data collectors were greatly helped by the Natural Coal Resources Coal System Project of the Kentucky Geological Survey. We also acknowledge Cordill Reels, William Anderson, and Gary Rainey from the Kentucky Geological Survey for reviews and edits.

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**Figure 10.** Slip failures in the western Kentucky coal field. These failures can occur on a variety of scales, including large-scale failures in the Coal Measures and small-scale failures in the Mercia Mudstone.