Mineral Resources of Indiana

Introduction

The purpose of this fact sheet is to introduce the reader to important mineral resources of the state of Indiana. The fact sheet will not provide a comprehensive discussion of all mineral resources found in the state. Instead, it will provide an in-depth look at three important resources.

The first page of the fact sheet provides introductory information related to Indiana’s mineral resources. Each of the three pages following the introduction will provide information about one valuable mineral resource.

The information provided in the in-depth look at resources will include:

- Chemical Composition
- Geology
- Geographic Location
- Commercial Uses
- Mining Techniques

What is a mineral?

In geology, a mineral is an element or chemical compound that has certain characteristics.¹

Minerals Produced in Indiana

- Coal
- Aluminum
- Lime
- Gypsum
- Steel
- Crushed Stone
- Dimension Stone
- Construction Sand and Gravel
- Petroleum
- Carbonaceous Shale
- Shale
- Natural Gas
- Oil
- Lead
- Zinc
- Barium
- Fluorine
- Iron Ore
- Peat
- Sulfur
- Common Clay
- Industrial Sand
- Mica
- Perlite

Mineral Characteristics:

- Naturally occurring
- Inorganically formed
- Specific Chemical Composition
- Crystal Form (how it grows)
- Cleavage (the way it breaks)
- Hardness (relative scale)
- Specific gravity
- Color (may be more than one)
- Streak (color when ground)
- Striations (may not be present)

What are Mineral Resources?

Many of the materials called “mineral resources” are not actually minerals. Some, such as coal, are organic in origin. Others are aggregates of minerals, and therefore considered rocks. Some, like oil, are liquids.

The term mineral resources refer to materials found in the earth that have an economic value. While this handout takes a geological look at mineral resources, it will use the common definition.

Coal

Coal is one of Indiana’s most important mineral resources. Indiana is a leading state in both coal production and consumption. Coal is the most abundant fossil fuel and an important resource for energy generation.

Geographic Location

Indiana’s coal deposits are found in the Illinois basin. Active coal mines are found in Southwestern and west-central Indiana. In 2000, coal mines were found in Vermillion, Vigo, Clay, Owen, Sullivan, Greene, Knox, Daviess, Gibson, Pike, Dubois, Warrick, and Spencer counties. ²

Geology

Indiana coal formed in swamps found in the state during the Pennsylvanian period. The Pennsylvanian period is a geologic time section referring to 286 to 320 million years ago. Coal comes from the remains of organic material, in this case, dead plants. Distinctive environmental conditions cause these plant remains to become coal.

Plant remains fall into the water of the swamp. The remains do not decay quickly due to the oxygen-poor nature of the swamp water and form an accumulation known as peat. Later, sediments bury the peat. As the thickness of the covering sediment increases, the peat experiences an increase in heat and pressure. Over time, this causes the peat to lose water and volatile hydrocarbons. The process does not stop when the original material has been altered enough to be considered coal. The coal gains a higher concentration of carbon as it continues. ²

Coal ranks refer to how much of the coal is carbon and essentially measure the amount of alteration. The coal ranks are, in increasing order of carbon concentration, lignite, bituminous, and anthracite. Indiana coal is bituminous, which means that carbon makes up around 80% of the coal. ³

Coal Mining

Indiana has underground and surface mines for coal. A majority of Indiana coal mine production comes from surface mines. In 2004, they were the source of 74% of Indiana’s total reported tonnage produced.

The year 2004 saw an increase in tonnage produced. (See table 1)⁴

Underground mining uses the room and pillar method. During mining, material is left to support the roof. This material is a pillar and the cleared sections are the rooms.

Surface mining removes the material covering the coal, called overburden. The material left is then blasted and the coal removed.⁵

Table 1: Indiana Coal Mine Production
Listing of the yearly tonnage of coal produced reported for the last eight years in Indiana.

<table>
<thead>
<tr>
<th>Year</th>
<th>Surface Mines</th>
<th>Underground Mines</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>26,550,556.18</td>
<td>9,266,371.63</td>
<td>35,816,927.81</td>
</tr>
<tr>
<td>2003</td>
<td>26,404,899.33</td>
<td>7,851,712.67</td>
<td>34,256,612.00</td>
</tr>
<tr>
<td>2002</td>
<td>28,254,510.55</td>
<td>8,290,914.01</td>
<td>36,545,424.56</td>
</tr>
<tr>
<td>2001</td>
<td>26,583,060.10</td>
<td>5,696,033.71</td>
<td>32,279,093.81</td>
</tr>
<tr>
<td>2000</td>
<td>27,166,317.32</td>
<td>4,585,642.34</td>
<td>31,751,959.66</td>
</tr>
<tr>
<td>1999</td>
<td>31,608,246.58</td>
<td>3,488,876.08</td>
<td>35,097,122.66</td>
</tr>
<tr>
<td>1998</td>
<td>32,820,450.88</td>
<td>3,389,444.28</td>
<td>36,209,895.16</td>
</tr>
<tr>
<td>1997</td>
<td>28,542,647.82</td>
<td>2,935,707.93</td>
<td>31,478,355.75</td>
</tr>
</tbody>
</table>

³ Leet, Judson, Kauffma 103, 352.
Gypsum

Gypsum is used as a building material, one of its main uses in the United States is in wallboard. It is also used to make plaster of Paris.6 Indiana is one of the leading states in national gypsum production. Indiana has been in the top 10 states in domestic Gypsum production for the past eight years. (See table 2)7

Geographic Location

Gypsum deposits (and deposits of the closely related mineral, Anhydrite), are found in both Southwestern and Northern Indiana.8

Geology

Unlike coal, Gypsum is a true mineral. Its chemical formula is CaSO₄·2H₂O. This formula means that the mineral is made of calcium, sulfate, and water molecules. Gypsum’s chemical name is calcium sulfate dihydrate.9

Gypsum is an evaporite, a type of sedimentary rock. Evaporite is a geologic term which refers to rocks formed by the evaporation of water that they were dissolved in, usually seawater.

Clearly there is no salt water to be found in current day Indiana. Therefore, it becomes clear that the gypsum deposits were formed sometime in the past when the conditions were quite different from the current day. In fact, gypsum in Indiana was deposited in the Mississippian period, another geological time section, which refers to 320 to 360 million years ago. During that time, there were shallow seas in the state.

Gypsum deposits in Southwestern Indiana are located in the lower part of the St. Lois Limestone. The depositional environment of the gypsum deposits of Southwest Indiana were coastal embayments.

The formation of gypsum involves an environment where salt water ends up on flat land. The water, carrying a high solution of the elements in gypsum, evaporates when heated by the sun. While many of the water molecules enter the atmosphere, the calcium and sulfate dissolved in the water is left behind. This increases the solution of the elements in the water. Eventually, the water mostly evaporates, and the salt is on the surface of the area. If this activity reoccurs, thick salt deposits will eventually form. There are a variety of saltwater environments that can result in evaporite deposition.10

In northern Indiana, Gypsum is part of the Detroit River Formation. The gypsum there is believed to have formed either in a lagoon environment, or in a sabkha environment. In this case, the water evaporated was ground water altered by interacting with nearby seawater or by flooding during storms.11

Gypsum Mining

In 2003, there were two gypsum operations in Indiana. Both mines were underground.12 Underground gypsum mining uses the room and pillar method described in the discussion of coal.


State of Indiana, Department of Natural Resources, Gypsum resources of Indiana, Robert R. French, and Lawrence F. Rooney, (Bloomington: State of Indiana, 1969) 3, 15.


---, ---, USGS, “Indiana State Minerals Information.”


State of Indiana, Department of Natural Resources, Gypsum resources of Indiana, Robert R. French, and Lawrence F. Rooney, (Bloomington: State of Indiana, 1969) 3, 15.


---, ---, USGS, “Indiana State Minerals Information.”
Dimension Stone

Dimension stone refers to any stone cut into a shape when used. It can be used for building construction, monuments, and other construction and decorative uses. Many different stone types are used as dimension stone.13

Indiana produces dimension limestone, dimension dolomite, and dimension sandstone.14 However, the state is best known for its dimension limestone. Indiana Limestone, also known as Salem Limestone, can be cut in any shape desired. This adds to the desirability of the stone.15

Indiana has been the leading domestic producer of dimension stone for the past five years. (See table 3)16

Geographic Location

Dimension limestone is found in South-central Indiana. In 2003, dimension limestone was produced in Monroe and Lawrence counties in multiple quarries. Dimension dolomite was produced in Rush county. Dimension sandstone was produced in Parke and Spencer County.17

Geology

Limestone, dolomite, and sandstone are all sedimentary rocks. Limestone is classified as a chemical sedimentary rock. The main component of limestone is calcite. The formation of limestone may or may not involve organic processes.

Inorganic limestone forms when weathering processes remove calcium from existing rocks, and calcium is dissolved in water. Various methods can cause calcite to precipitate from the resulting solution, eventually forming limestone.

Organic limestone includes the remains of animals. These remains are the hard parts of the animals, shells for instance, and contain calcite. Dolomite is similar to limestone, but the main component is dolomite.

Sandstone forms when sediments from weathered and eroded remains of previous rocks compact to become stone. Its determining characteristic is the size of the grains of material in the sediment. Sandstone comes from sand sediment. This means that the grains in the stone range from 0.0625 to 2 mm in diameter.18

Dimension Stone Mining

In 2003, almost all dimension stone quarries in Indiana were surface quarries with only one underground quarry in operation that year.19

In open pit surface quarries, a small surface area is typically used. Instead of expanding out, the quarrying moves down, creating a subsurface pit.

Underground quarrying of dimension stone uses the room-and-pillar method previously described.20

Limestone was used in the construction of the Empire State Building.13

<table>
<thead>
<tr>
<th>Year</th>
<th>Indiana’s Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>1st</td>
</tr>
<tr>
<td>2003</td>
<td>1st</td>
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<td>1998</td>
<td>2nd</td>
</tr>
<tr>
<td>1997</td>
<td>2nd</td>
</tr>
</tbody>
</table>

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14 “Indiana State Minerals Information.”


17 “Indiana State Minerals Information.”

18 Leet, Judson, and Kauffman 100-102.
