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with appendix
by
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COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
BUREAU OF
TOPOGRAPHIC AND GEOLOGIC SURVEY
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PREFACE

This report describes the nature and occurrence of the various rock layers found at and below the surface of a 112-square mile area of west-central Clearfield County. Particular attention is also paid to the rock and mineral resources which have economic importance.

The surface rocks in the northeastern part of the report area consist chiefly of massive white sandstone underlain by a sequence of thinner-bedded reddish or greenish shale, siltstone and sandstone. The remainder of the area is underlain at the surface by alternating thin layers of sandstone, shale, siltstone, limestone, clay, and coal. The sequence of rock layers is described in detail and the various changes in rock type from place to place are discussed. The report also includes information on the subsurface rocks of this area based on records of the many gas wells drilled here.

Locations, quality, and quantity of the various mineral resources found in the report area are described. Coal is the most important mineral resource with unmined reserves of 190 million tons in beds over 14 inches thick, including 115 million tons in beds over 28 inches thick. The area also includes part of the Punxsutawney-Driftwood gas field. Clay and shale for use in ceramic products are an important mineral resource of the area and are described in detail.

This report provides an inventory of geologic information prerequisite to land planning and mineral resource development for the future. It is expected to be of particular use to the mineral industries in view of the extensive mineral resources cited. Highway and construction engineers will be able to evaluate ground construction conditions in advance of operations and an engineering characteristics map is included to assist in that respect. Planning organizations will be able to recognize the valuable mineral-bearing areas as well as areas where construction will be difficult. Those interested in water resources will be better able to evaluate the distribution and controls on the occurrence of ground water.

This report is intended for both professional and non-professional readers. The language used has been kept as simple as possible without sacrificing accuracy. Where more exact geological terms must be used, they are defined in the glossary at the end of the report. It is advisable that those not well versed in geology obtain the assistance of a competent professional in making important or costly decisions requiring geological interpretation.

Glen Richey Formation Shales

As the greatest part of the Glen Richey Formation across the report area is cut out by the lower Mahoning sandstone channels, the few areas where shale might occur near the surface are of little importance.

Conemaugh Group Shales

The maximum remaining section of Conemaugh rock is about 320 feet thick in northwestern Luthersburg quadrangle. No information is available on the upper 100 feet, although it is likely to contain some shales.

In the lower 220 feet, the 160-foot interval between the Mahoning coal and the Pine Creek (?) limestone is composed largely of clay shale, silt shale, and thin-bedded siltstones. None of it has ever been used or tested for ceramic purposes, although the 70 feet of silt shale and siltstone immediately below the Pine Creek limestone has been extensively used as construction fill.

Where the lower Mahoning sandstone is poorly developed, a 35-foot section of underclay, clay shale, claystone, and limestone occurs below the Mahoning coal. This interval would lie about 30 to 65 feet above the position of the upper Freeport coal.

NATURAL GAS

General

Of the two fossil fuels produced in the southern half of the Penfield quadrangle, natural gas ranks second to coal. This area includes part of the Punxsutawney-Driftwood Field of the Appalachian oil and gas Province. More specifically, it includes slightly less than half of the Rockton (Luthersburg) Pool and about half of the Helvetia Pool. These are both deep producing pools. A small, unnamed shallow pool exists in the area south and west of Luthersburg.

Deep gas production is from the Oriskany Formation (Ridgeley Sandstone Member) and the overlying Onondaga Formation. Shallow production is reported to be from the Bradford third sand of the Canadaway Group (equivalent to upper part of the "Devonian marine"). Natural gas accumulation may well be related to the deep fault system, but variations in reservoir porosity and permeability definitely have their effects.

Structural Setting

Boundaries of the gas pools closely coincide with the area of deep, high-angle reverse faulting on the northwestern flank of Chestnut Ridge anticline (Plate 12). In 1959, Lytle and others (p. 6-7) indicated that the trapping mechanism is primarily stratigraphic and that faulting is a complication.

Where there is enough displacement, it seems possible that gas may accumulate in the hanging wall, at the uptilted ends of fault blocks. It appears more than coincidental that dry wells frequently occur along the down-thrown sides of the northeast-trending reverse faults. In many cases then, gas accumulation may be due equally to both structural and stratigraphic trapping mechanisms.

That no pools have formed along the axis of Chestnut Ridge anticline in this area, attests to the fact that sand characteristics and thickness do strongly control gas accumulation. Lytle and others (1960, p. 10) have pointed out that the thickest accumulation of Ridgeley ("Oriskany") sandstone approximately coincides with the axis of the Punxsutawney-Caledonia syncline and thins toward the flanking anticlines.

Producing Horizons

Onondaga-Ridgeley Interval ("Oriskany") (Deep Well Production)

The Onondaga chert (Onondaga Formation, Middle Devonian) and the immediately underlying Ridgeley Sandstone Member (upper member) of the Oriskany Formation (Lower Devonian) constitute the major production interval in the report area. The Onondaga chert section averages about 40-80 feet thick and the Ridgeley Sandstone averages 10-20 feet thick.[1]

The Onondaga chert is a brownish gray, slightly silty, usually non-calcareous, bedded chert with some dark siliceous shales in the lower part. Generally, the chert does not yield the first show of gas. Only after the Ridgeley sandstone has been penetrated, and the whole interval hydraulically fractured, does the chert yield a significant gas flow (Lytle & others, 1959, p. 8). In addition, the chert section normally cannot be considered a potential reservoir unless accompanied by an effective Ridgeley reservoir.

The Ridgeley Sandstone is light gray, medium- to coarse-grained quartzose sandstone; it is usually cemented by calcite, but some silica cement occurs near the top. Sufficient pore space has been retained to make the sand body an easily exploitable reservoir.

Upper Devonian Sands (Shallow Well Production)

Only sparse and inexact information is available on the shallow-sand gas pool. Cumulative production is almost negligible compared to deep-sand production. The principal producing horizon is reported to be the Bradford third sand (Canadaway Group, Upper Devonian). This unit is normally about 900 feet below the "Pink Rock" of drillers' terminology (upper part

[1] The lower member of the Oriskany Formation (Shriver) is difficult to differentiate from the underlying Helderberg Formation, so discussion of the production horizons is restrictive in that "Ridgeley" is used instead of "Oriskany" as a whole. In subsurface oil and gas terminology the term "Oriskany" refers to the "Ridgeley" only.