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PENNSYLVANIAN STRATIGRAPHY IN THE SOUTHERN WASATCH MOUNTAINS, UTAH

H. J. BISSELL.

The area under consideration has a dimension of 8 miles east-west and 4 miles north-south, and includes the canyons of Spring Creek and Hobble Creek, Utah County, Utah. These streams flow off the west flank of a southern portion of the Wasatch Range, and have cut canyons to a depth of over 3,000 feet, exposing sections of upper Paleozoic sediments.

Pennsylvanian rocks in the vicinity of the southern Wasatch Mountains have received little attention from stratigraphers. In this paper an attempt is made to describe the sequence of Pennsylvanian rocks in the region.

PENNSYLVANIAN SYSTEM

There are exposed about 4,000 feet of Pennsylvanian sediments. In lithology they consist essentially of interbedded limestones and sandstones, with a subordinate amount of shale, and at two horizons conglomerates occur. Some of the limestone is siliceous and some of the sandstone is quite quartzitic. These rocks have never been described, but have been briefly referred to the Oquirrh formation, which has its type section in the southern Oquirrh Mountains.

OQUIRRH (?) FORMATION

Lithology — The Oquirrh (?) formation has two facies which can be recognized readily. The lower facies is made up of sandstones, limestones, shales, and conglomerates. The sandstones are generally fine-grained rocks, rather dark gray to grayish-green on fresh fracture and rather reddish brown on weathered surfaces. The detrital grains of quartz are usually visible to the naked eye. The sandstones themselves are not resistant to erosion, and some of them show distinct laminations. Silica-cemented sandstones predominate over lime-cemented sandstones, and there seems to be no systematic relation between the two varieties of cementing material.

The limestones vary greatly in nature, and this has undoubtedly resulted from varying conditions of deposition. Many of the limestones are fine-grained, dark bluish-gray on fresh fracture and

light bluish-gray on the weathered surface. Such beds sometimes contain silica, as much as 50%, either in the form of sandy laminae or as chert nodules or chert replacements of fossils. There is some thin-bedded platy limestone which is nearly black on fresh fracture and purplish on weathering. Such beds are frequently fossiliferous and contain large numbers of *Fusulinids*.

The shales are usually chocolate brown to light brown in color and may be sandy or limy. They are generally not very compact.

The conglomerates constitute but two stratigraphic beds, one being over 500 feet above the other. These beds are composed of angular blocks of limestone and sandstone. The angular blocks show very little evidence of mechanical wear, and are as large as one foot across a face.

This lower facies is predominantly sandstone and limestone interbedded. It is a very pronounced fact that the sandstone is quite calcareous, and the limestone is very siliceous, in some instances exceeding 50% quartz grains. There are, of course, many quite pure limestones, and many such sandstones, but the tendency is towards a gradation between the two.

The upper facies of the Oquirrh (?) formation shows a distinct change from the lower one, this being indicated in four characteristics: (1) the upper facies shows a marked increase in thickness of beds of limestone, and also in thickness of beds of sandstone, with some beds in each being in excess of 100 feet thick, as compared with 5 to 20 feet thick in many of the beds of the lower facies; (2) there is a lack of both shales and conglomerates; (3) many of the limestones change from finely crystalline to coarsely crystalline texture, and sandstones show an increase in the number of sand grains; (4) there is a distinct tendency for the limestones to become quite pure in composition, having in some cases 98% soluble material, essentially calcite. The sandstones tend towards an increase in quartz.

In the upper facies is exhibited also a change in the color of sediments, the limestones becoming darker, and the sandstones becoming more reddish-brown.

The writer feels that the present nomenclature is insufficient for the needs of describing the Pennsylvanian sediments of the southern Wasatch Mountains. The suggestion is here made that in this region the term Oquirrh be elevated to the rank of series to include all the beds from lower to upper Pennsylvanian, and that the lower facies be named the Kelly formation, and the upper facies be named the Hobble formation.

TYPE SECTION OF BEDS OF KELLY FORMATION IN HOBBLE CREEK CANYON

Central portion of T. 7 S., R. 3 E., Utah

| Bed | Description | Thickness in feet |
|-----------|--|----------------------|
| 19 | Sandstone, friable; some limestone present----- | 122 |
| 18 | Conglomerate, angular fragments of limestone and sandstone are 1 to 12 inches square----- | 8 |
| 17 | Limestone, siliceous, interbedded with sandstone, quartzitic, both gray in color----- | 210 |
| 16 | Sandstone, light-gray to brown, interbedded with limestone, finely crystalline, light blue to gray color----- | 215 |
| 15 | Conglomerate, angular fragments as in bed 18----- | 20 |
| 14 | Limestone, soft, siliceous, resistant, gray----- | 20 |
| 13 | Sandstone, soft, friable, interbedded with limestone, siliceous, finely crystalline; bedding 1-4 inches----- | 195 |
| 12 | Shale, sandy, chocolate color, beds 1-4 inches----- | 12 |
| 11 | Limestone, siliceous, light-gray; bedding 4 inches to 1½ feet-- | 70 |
| 10 | Sandstone, slightly calcareous, light brown, interbedded with limestone, highly siliceous, light gray; bedding 1-3 feet---- | 290 |
| 9 | Sandstone, soft, friable, reddish-brown on weathered surface, grayish-green on fresh fracture; bedding 6 inches to 5 feet-- | 100 |
| 8 | Shale, sandy, brown; bedding ¼ inch—4 inches----- | 50 |
| 7 | Limestone, siliceous, dark gray, interbedded with sandstone, calcareous; bedding 3 feet----- | 205 |
| 6 | Limestone, light-gray, slightly siliceous----- | 9 |
| 5 | Sandstone, calcareous, light brown, interbedded with siliceous gray limestone ----- | 230 |
| 4 | Limestone, grades from very cherty below to slightly cherty above ----- | 105 |
| 3 | Limestone, blue on surface, dark to black on broken or fractured surface ----- | 8 |
| 2 | Sandstone, quartzitic, with lens of siliceous limestone, both light brown to gray----- | 9 |
| 1 | Limestone, finely crystalline and light blue to gray in color-- | 6 |
| Total---- | | 1,885 |

TYPE SECTION OF BEDS OF HOBBLE FORMATION IN
HOBBLE CREEK CANYON

East-central portion of T. 7 S., R. 3 E., Utah

| Bed | Description | Thickness in feet |
|-----|--|----------------------|
| 35 | Sandstone, very quartzitic, some lenses of very slightly siliceous limestone, both rocks brown to reddish-brown---- | 30 |
| 34 | Limestone, medium crystalline and very resistant; dark blue in color----- | 12 |
| 33 | Sandstone, very quartzitic, light brown----- | 60 |
| 32 | Limestone, medium to coarsely crystalline; very resistant, dark blue in color----- | 10 |

| | | |
|------------|---|-------|
| 31 | Sandstone, friable, lenses of limestone, almost pure; both beds gray to brown in color----- | 20 |
| 30 | Limestone, partly sandy, with interbeddings of quartzitic sandstone ----- | 400 |
| 29 | Sandstone, quartzitic, interbedded with limestone, slightly siliceous; both light gray to brown in color; have iron oxide coating ----- | 150 |
| 28 | Limestone, medium crystalline, dark blue in color; has veins of aragonite ----- | 25 |
| 27 | Sandstone, highly quartzitic, light-brown color, interbedded with limestone, slightly siliceous, light-gray in color----- | 350 |
| 26 | Limestone, medium crystalline, dark blue to black in color-- | 4 |
| 25 | Limestone, slightly siliceous, interbedded with very quartzitic sandstone; both rocks light gray to brown color----- | 150 |
| 24 | Sandstone, very quartzitic, light gray; lens of sandy limestone in lower 10 feet----- | 350 |
| 23 | Limestone, medium crystalline, light gray, lower 15 feet has 3-8 inch bedding----- | 85 |
| 22 | Limestone, light gray to blue color, slightly shaly; bedding 3-8 inches ----- | 15 |
| 21 | Limestone, finely crystalline, massive, has 4 ft. lens siliceous limestone ----- | 50 |
| 20 | Limestone, medium crystalline, light gray to blue color; bedding 2-6 feet----- | 100 |
| Total----- | | 1,751 |

The locality to study the type sections of these Pennsylvanian formations is in the central portion of Township 7 South, Range 3 East, east of Springville, Utah County, Utah, in Hobbble Creek canyon.

DEPOSITION OF THE SEDIMENTS

The contact between the limestone and sandstone beds is usually distinct, indicating a rapid change in the conditions of deposition. These Pennsylvanian formations were deposited at the critical point of sedimentation — the boundary line between the arenaceous detrital deposits and those calcareous sediments which derived but part of their material directly from the degradation of the land. The closely alternating beds of these formations does not necessarily indicate repeated minor oscillations of the sea bottom during their deposition.

The beds containing the clastic rocks were probably worked by currents during their deposition. Yet the fine limestones, which rest directly upon the sandstones and interbed with them might have had an environment free from powerful currents.

It appears that in the region of the southern Wasatch Mountains

the Oquirrh (?) series was deposited in relatively shallow water not far from land and upon an unevenly and constantly sinking sea bottom.

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