

Proceedings of the Iowa Academy of Science

Volume 1 | Part 4, 1893; (1887) -

Article 15

1893

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H. Foster Bain

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Recommended Citation

Bain, H. Foster (1893) "Sigourney Deep Well," *Proceedings of the Iowa Academy of Science*, 1(Pt. 4), 36-38.

Available at: <https://scholarworks.uni.edu/pias/vol1/iss4/15>

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An examination of these different sections shows a remarkable persistence of character. The thin clay parting remains constant between two and three inches over the whole distance. The greatest variation is shown in the underlying fire clay and overlying shales.

In Iowa this coal has been found along both branches of the Chariton river in the northeastern part of Wayne county, and mined near Grflinsville and Milledgeville, in the northwestern part of Appanoose county. Its presence on Little Walnut creek, near Walnut City, is known. It is well exposed along Big Walnut, and is extensively mined at Brazil, Mystic and Rathburn. It has been mined at Plano, Garfield, Dennis, and a few miles southwest of Moravia. There is a coal exposure on Soap creek, at Foster, in Monroe county, which may be the same. At Centerville, Numa, and Jerome, the coal is mined at depths of about one hundred and twenty-five to one hundred and sixty feet, while at Seymour in Wayne county, it is reached at two hundred and forty-three feet; and at Howard, in the same county, is reached at a slightly less depth. At Livingston and Cincinnati, in the southern part of Appanoose county, it lies nearer the surface; near Hillstown, in the southeastern part of the county, it outcrops along the Chariton. Coal is mined at Coatsville, in Schuyler, Stahl, in Adair, and Mendota, Unionville, and other points in Putman counties in Missouri, which has been considered* to belong to the same seam, and part of it at least, has been directly correlated† with the Mystic coal. Without doubt this is a continuation of the vein mined in Iowa; since the mines at Cincinnati, Iowa, and Mendota, Missouri, are only a short distance apart, and the same is true at Hillstown and Coatsville. The character of the coal, and the attendant strata, as well as the general geological relations in the region in question, all bear on this assumption.

The presence of a seam of coal with such exceptionally uniform character and wide geographical limits within the boundaries of the lower coal measures as now recognized, is an item of considerable economic, as well as scientific interest. It has had a very important bearing upon the development of the coal industry of that portion of Iowa, and has been one of the leading factors in the remarkable growth which that industry has there experienced.

SIGOURNEY DEEP WELL.

BY H. FOSTER BAIN.

During the summer of 1888 a deep well was drilled at Sigourney, in Keokuk county. Captain Parker, who was at that time mayor, carefully preserved samples of the different strata passed through. These samples have recently been re-examined, and form the basis of the following notes.

*Winslow: Geol. Sur. Mo., Prelim. Rep. on Coal, pp. 54-62, Jefferson City, 1891.

†Norwood: Rep. Mo. Geol. Sur., 1873-1874, p. 295, Jefferson City, 1874.

While the unreliability of records derived from the ordinary or churn drill is fully recognized, it is believed that the care with which these samples were selected and preserved, at least considerably reduces that element of doubt. Previous accounts of this record have been published in the local newspapers, and re-published by C. H. Gordon in the *American Geologist*.^{*} Recent studies in the region, as well as a revision of the material, give, however, considerable information not available at that time.

The following table represents the record as recently determined, as well as the interpretation:

1- 98	Earthy matter.....	98	Drift.....	98
98- 120	Limestone, impure, earthy.....	22		
120- 135	Limestone, cherty.....	15		
135- 155	Shale, calcareous.....	20		
155- 165	Limestone and shale.....	10		
165- 170	Limestone, hard, bluish gray.....	5		
170- 187	Limestone, cherty, light.....	17	Saint Louis... 89	
187- 189	Shale.....	2		
189- 314	Limestone, hard, white with brown particles.....	125		
314- 315	Shale, dark green.....	1		
315- 356	Limestone, grayish white to drab, <i>Rynchonella</i> at 342 ft..	41	Augusta....	168
356- 554	Shale, soft, green.....	198		
554- 556	Limestone.....	2		
556- 585	Shale, soft, green.....	29	Kinderhook.	229
585- 835	Limestone.....	250	Devonian....	250
835- 865	Sandstone.....	30		
865- 871	Limestone.....	6	Niagara.....	36
871-1030	Shale, blue argillaceous.....	151	Maquoketa..	151
1030-1275	Limestone.....	245		
1275-1281	Shale.....	6	Trenton and	
1281-1315	Limestone.....	34	Galena....	285
1315-1430	Sandstone.....	115	Saint Peter..	115
1430-1717	287		
1717-1888	Limestone.....	171	Oneota.	

A comparison between this and the previously published record shows several discrepancies. The drift is in both cases given as 98 feet deep. The next 89 feet is now referred to as the Saint Louis, whereas it was formerly considered to be Keokuk. There are a number of reasons for this change. In the first place, an examination of the samples shows that the beds are not a single homogeneous limestone as represents the Augusta of this region, but are made up of alternating bands of limestone and shales such as compose the Saint Louis. It is also worthy of note that the particles of limestone preserved are of the fine grained, compact character and ash to brown color so constantly seen in the Saint Louis of this immediate region, and not of the coarser crystalline variety shown in the nearest exposures of Keokuk.

The topographic features also bear out this assumption. A line of levels shows that the mouth of the well is 118 feet above the bed of the river two miles south of town. Saint Louis limestone is exposed along the river, reaching here a height of nearly twenty feet, or about what it would be if on a level with the strata found in the well, which are referred to the same age.

^{*}Gordon, Notes on the Geology of Southeastern Iowa (Am. Geol., IV, 237-239, 1889.)

Keyes* has recently shown that the two limestones found in southeastern Iowa, and long known as the Keokuk and Burlington, are really conformable members of the same formation to which the name Augusta has been given.

Worthen,† in his notes on Washington county, calls attention to remarkable thinning out of the Keokuk; it being greatly reduced or entirely absent over the regions studied. This observation has, during the present field season, been completely substantiated, not only for Washington, but Keokuk county. These facts taken together, all point to the same conclusions: that the first 89 feet of limestone pierced belongs to the Saint Louis, while the Keokuk is represented merely in a few feet of the succeeding 168 feet of strata. The two bands of heavy limestone comprised in the strata thus referred to, the Augusta, are closely similar in lithological character, and resemble the Augusta limestone of the region as nearly as can be determined. At a depth of 342 feet a fossil, *Rhynchonella* sp. und., was brought up, it being the only fossil preserved. Below this point the element of uncertainty becomes greater. The succeeding 229 feet of shale is probably all referable to the Kinderhook, though the thickness is somewhat greater than an examination of the Washington county outcrops seem to indicate. The 250 feet of limestone which succeeds is most probably Devonian. The succeeding 30 feet of sandstone and 6 feet of limestone are more probably Niagara, since Calvin has shown that the Niagara at Washington is arenaceous. It is possible, however, in this case, that the sandstone encountered may be of Devonian age and represent the Montpelier sandstone. The overlying limestone being the Cedar Valley.

The Maquoketa shale seems, by comparison with neighboring records, to be well recognized.

The heavy limestone band, 285 feet, succeeding the shale is probably representative of the Trenton and Galena, though it seems impossible to draw a good line between them.

The 115 feet of sandstone which succeeds seems to be the Saint Peter. Beneath this for some distance no samples were obtained as the current of water struck was so strong as to wash away all the drillings. The lower position of the well yielded samples which an examination proved to be limestone as Gordon surmised, and not sandstone as published. This seems to clearly prove that the well ended in the Oneota, though the top of the formation was not definitely located nor was it penetrated, so that its thickness under this portion of Iowa is as much a problem as ever.

The well was sunk in hopes of obtaining strong flow of artesian water. A moderate flow was obtained but has never been used to any great extent. At 1,320 feet in the Saint Peter sandstone a vein of water was struck which contained mineral matter and possessed a strong odor. At 1,360 feet in the same formation an opening was struck and the drill suddenly dropped two feet. A strong current of fresh water carried off all the samples and the water increased to the depth of 1,388 feet, when it flowed over the top of the well while drilling and stood within thirty feet of the top when the drill was at rest. No more water was struck from here to the bottom of the well.

*Keyes, Geological Formations in Iowa (Iowa Geol. Sur. I, First Ann. Rep., 1892, 59-60, Des Moines, 1893).

†Worthen, Geol. of Iowa, vol. I, p. 244, Albany, 1858.