and was put down by the Forest Oil Company in 1897. The well was dedicated to science and had for its purpose drilling down and into the Corniferous limestone, but after a depth of 5,575 feet was reached an accident beyond repair occurred and further drilling was from necessity abandoned. The well was begun 130 feet below the Pittsburgh coal, and after passing through rocks of the Carboniferous (Pennsylvanian and Mississippian) and of the Upper and most of the Middle Devonian, was bottomed (5,575 feet) in supposed Marcellus black shale, probably not more than 100 feet above the Corniferous limestone. The vast thickness of rocks penetrated by the well were all sedimentaries, including, according to the log,[3] shales, slates, coal, sandstones and limestones, as the chief lithologic types.

At the request of Dr. White, Professor William Hallock, of Columbia University, was afforded every facility for measuring the temperature of the well. A brief statement of the temperatures measured in the well was published by Professor Hallock in 1897.[4] Five measurements made at different depths are recorded by Dr. White. These may be tabulated as follows:[5]

TEMPERATURE MEASUREMENTS IN WEST ELIZABETH DEEP WELL

Temperature at		Difference in temperature for		Kind of rock
525 ft.	57° F.			Sand.
2,252 ft.	64	1,677 ft.	7° F.	Slate
2,397 ft.	78	445 ft.	14	Slate and shells.
5,010 ft.	120	2,613 ft.	42	Limestone.
5,380 ft.	127	370 ft.	7	Slate.

The figures in the table above explain themselves and need no comment except that the increment of heat is shown to be exceedingly variable, and is in accord with many other deep wells over the earth's surface in which temperature measurements have been made. The explanation offered for the variation in temperature shown in this well is the presence of a considerable flow of natural gas from the Bayard sand at 2,282–7 feet.[6] The average increment of heat for a depth of 4,855 feet, which represents the difference between the least (525 feet) and the greatest (5,380 feet) depths at which temperature measurements were made, is 1° F. for every 69.3[7] feet.

THOMAS L. WATSON
UNIVERSITY OF VIRGINIA

[3] A complete log of the well is published by Dr. White in Volume I(A) of the West Virginia Geological Survey, 1904, pp. 104–107.

[4] Hallock, W., *School of Mines Quarterly*, 1897, pp. 151–153.

[5] Data taken from Vol. I(A) of West Virginia Geological Survey, 1904, pp. 104–107.

[6] Professor Hallock states that "the thermometers at 2,250 feet indicated a cooling due to the expansion of the gas amounting to about 14°." *Op. cit.*, p. 153. Gas, volume 25 lbs. per min., West Virginia Geol. Survey, Vol. I(A), p. 105.

[7] Professor Hallock gives the increment of heat from top to bottom (5,000 feet) of well as 1° F. for 71.5 feet. *Op. cit.*, p. 150, table II.

ADDITIONAL NOTE ON RETICULATED FISH-SCALES

SINCE the publication of my recent account of dipnoan fish scales in SCIENCE, some interesting facts have come to light.

1. Dr. L. Hussakof, of the American Museum of Natural History, has very kindly placed in my hands scales of *Sagenodus* from the Carboniferous rocks of Mazon Creek, Illinois. A well-developed scale is oval, about 50 mm. long and 37 broad, and in appearance and structure essentially agrees with the scale of the living (Australian) *Neoceratodus*. The reticulations are evident, and the very fine basal longitudinal fibrillæ are minutely tuberculate. Thus we have positive evidence of the enormous antiquity of this type of scale, including even the details of structure.

2. A specimen of the sucker *Moxostoma cervinum* Cope, collected by Dr. B. W. Evermann, proves to have two kinds of scales. One has a quadrate form, with strong laterobasal angles, strong apical and basal radii, the circuli dense in the basal and lateral fields, but widely spaced in the apical. This is the sort of scale we are accustomed to find in *Moxostoma*, a scale strongly suggestive of various old-world cyprinids. The other type of scale has the laterobasal angles more rounded, radial lines running to the margin

all around, and the very broad central area occupied by irregular, more or less elongated reticulations. Thus the scale comes to closely resemble those of the Mormyridæ. As it now seems evident that the ancestors of the Teleosteans must have had reticulated scales, or at least that the ordinary radial sculpture is derived from the reticulated type, this *Moxostoma* scale must be regarded as uniquely primitive or atavistic for the general group to which it belongs.

3. Dr. G. A. Boulenger has very kindly sent me scales of the cæciliid amphibian *Ichthyophis glutinosus.* These are very small, embedded in the skin, cycloid in form. The pattern is extremely characteristic, consisting of concentric grooves connected at intervals by cross-lines, the whole effect being like that of bricks in a wall. The concentric grooves are probably not circuli, nor can I make out anything corresponding to the circuli of fishes. In parts of the scales, however, the markings become irregular, producing a reticulation which closely simulates that of the reticulate-scaled fishes. I believe that the scales are really comparable to fish-scales, and that the sculpture is the same as the radial sculpture of fishes. No fish scale has been seen resembling in detail that of *Ichthyophis;* such scales as those of *Chrosomus* are superficially similar, but owe their circular lines to different elements.[1]

T. D. A. COCKERELL
UNIVERSITY OF COLORADO

NOTES ON THE GENUS TYPHA AND ITS NEMATODE ROOT GALL—HETERODERA RADICICOLA (GREEFF) MULL.

DURING the summer of 1908, while investigating some problems connected with the root system of *Typha latifolia,* I found a number of abnormal growths on the rootlets. These growths appeared as irregularly spherical or fusiform enlargements, varying in size from 1 to 5 mm. in diameter. They were identified by Professor Atkinson as root galls caused by the nematode *Heterodera radicicola.* I have collected these galls at the same station (limnology station of Cornell University) three successive years, but have never found them on *Typha* in any other locality.

Professor Atkinson[1] thought, from his observations of this worm on potatoes and tomatoes, that, if favorable opportunity should occur for its introduction in the north, it might become a pest. Webber and Orton[2] say it will never become a serious pest in the north, as severe cold kills the worm. Van Hook[3] reports the worm as wintering in ginseng beds which had been mulched and also in protected forest beds. This worm has been a serious pest to ginseng in the north.

Stone and Smith[4] found the galls on outdoor plants, but concluded that they were transient.

The plants observed by me in the Cayuga marshes are located along the shore line of one of the arms of Fall Creek where moisture is plentiful in the soil all winter. Winter observations prove that the soil in which the galls are found does not freeze. None of the galls have been found more than eighteen inches below the surface.

L. N. HAWKINS

[1] Since this was written, I have found that a deep-sea eel, *Synaphobranchus pinnatus,* has scales curiously similar to those of *Ichthyophis.*

CORRELATION NOTES

IN describing the fauna of the Moorefield shales of Arkansas[1] Mr. George H. Girty lists and describes the following fossils among others from the region: *Productus inflatus* var. *coloradoensis* Girty (?),[2] *Productus arkansanus* var. *multiliratus* Girty,[3] and *Diaphragmus elegans* Norwood and Pratten.[4] By a comparison of the figures of these fossils on plate iv.[5] with fossils which the writer collected

[1] Bull. 9, Alabama Exp. Sta.

[2] U. S. Dept. Agr., Bur. Plant Ind., Bull. 17, 1902.

[3] Cornell Agr. Exp. Sta., Bull. 219, 1904.

[4] Bull. 55, Mass. Agr. Exp. Sta., 1898.

[1] "The Fauna of the Moorefield Shale of Arkansas," U. S. Geol. Survey, Bulletin No. 439.

[2] *Ibid.,* pp. 42–43.

[3] *Ibid.,* p. 43.

[4] *Ibid.,* pp. 51–52.

[5] *Ibid.,* plate iv.