SPECIAL ARTICLES

AN INTERMITTENT SPOUTING WELL

IN parts of central Florida bored wells are somewhat extensively used for drainage purposes. The wells are drilled through the superficial material and as a rule enter the Vicksburg Limestone of Oligocene age, although other porous limestones may serve the same purpose. Many of the wells terminate in cavities in the limestone, while others reach layers of shell or other porous material. Surface water entering the wells is carried into the limestone formation. In some localities in the central part of the state these wells have been found very efficient in carrying off surface water and in draining small marsh areas for agricultural purposes.

One of these drainage wells near Orlando, in Orange County, recently developed the unusual phenomenon of spouting. The well was drilled in 1907 and is located near the edge of a small lake. It is twelve inches in diameter and has a total depth of 260 feet, and is cased 60 feet. The level of permanent underground water at this locality is 33 feet from the surface. Trucking is carried on around the edge of the lake and the well is intended, by carrying off the surplus water, to prevent the lake from rising above a given level, since to do so would flood the farming land. The well is similar in character to the other drainage wells of this locality and, as in the case of most of the other wells, terminates in a cavity in the limestone.

The well was first seen by the writer October 4, 1910. At this time the water of the lake stood a few inches above the level of the top of the pipe, and the well was receiving water at much less than its full capacity. At intervals of a few minutes the well would reverse itself and spout, throwing a column of water into the air. The spouting comes on gradually. First the well ceases to receive water and begins bubbling; the column of water follows, rising with considerable force to a height of twenty feet or more above the surface, the spout occurring with tolerable regularity at intervals of four minutes. The manager of the farm states, however, that the interval between spouts varies from two to fifteen minutes, being probably influenced by varying conditions under which the water enters the well.[1]

Although drilled three years ago and receiving water more or less continuously during that time the phenomenon of spouting developed for the first time on September 26, 1910, the first spouting having occurred about eight o'clock in the morning of that day. The well continued spouting without interruption for a little more than a week and until shut off by the owner.

Various fanciful theories have been advanced to account for the spouting, including supposed occurrence of gas and oil, and the supposed influence of recently formed sinks in the interior of the state. The true explanation is evidently much more simple. At this stage of the lake the well is receiving water at less than its full carrying capacity and as the water enters the vertical pipe it forms a suction, carrying a large amount of air into the well, which doubtless collects in a chamber or cavity along the side or at the bottom of the well. As the well continues receiving water the air accumulates under pressure in this chamber until ultimately the pressure under which the air is confined is sufficient to overcome the weight of the overlying water plus the inertia of movement, and hence rushes out with considerable force, carrying the column of water with it. The fact that the well when first drilled did not spout and afterwards began spouting doubtless indicates that the essential conditions were subsequently developed either by caving or by other changes in the underground conditions.

When partly shut off so that only a limited amount of water enters the well the air taken into the well is able to return to the surface freely and under these conditions spouting ceases. It is probable that if an elbow is placed on the well, allowing the water to enter laterally instead of vertically, the amount of air taken into the well will be so far reduced that the spouting will cease. Likewise when the lake rises so that the water stands several

[1] A photographic illustration of the spouting well will be found in the Third Annual Report of the Florida Geological Survey, pl. 9, 1910.

feet above the top of the pipe entering the well the spouting should cease, since the pipe will then be carrying water at its full capacity with little or no air under these conditions entering the well. As a matter of fact following the heavy rains attending the storm of October 17 and 18, 1910, the lake rose several feet and the well upon being reopened received water without spouting. A similar spouting well at Albany, Ga., was described some years ago by Professor S. W. McCallie.[2]

E. H. SELLARDS

TALLAHASSEE, FLA.

GRAPHITE IN VEIN QUARTZ[1]

THE writer has recently discovered a graphitic quartz in Troup County, Ga., which has some geological significance, since it is entirely unlikely that the graphite is directly of organic origin. The graphite occurs in massive vein quartz and, recognizing the already known occurrence of graphite in pegmatite and gneiss at other localities, affords additional evidence of the inorganic origin of graphite under peculiar geological conditions.

The graphite occurs in small flakes and in irregular bunches, two or three millimeters in diameter or length, disseminated through massive, clear quartz. In fact, in the specimens at hand, except for iron stains, quartz and graphite are the only components of the rock. Under the microscope, minute black crystals were noted, but the black color disappeared upon ignition, leaving the crystal form intact, indicating only a covering of graphite over minute quartz crystals. The graphite, roughly estimated, forms only two or three per cent. of the quartz at present exposed.

The nearest rock exposed in the vicinity of the quartz vein is a peridotite and it is not improbable that the vein is cutting this rock. The quartz, of course, could possibly be derived from pegmatite, but at the surface neither feldspar nor mica were found with it. The vein is evidently of small dimensions. The nearest strata of certain sedimentary origin are the Pine Mountain quartzites a few miles to the southward.

Whether the quartz was deposited from an aqueous solution or is of aqueo-igneous origin, the carbon must have been held in some form in the rock solution and the graphite deposited contemporaneously with the quartz. Its dissemination, not cavity filling, through compact, crystalline quartz is sufficient evidence that it is not directly of organic origin or derived from the metamorphism of carbonaceous matter. Perhaps the most suggestive theory of the origin of the graphite under these conditions is that it was derived from carbon dioxide (CO_2), or a hydrocarbon vapor held in the siliceous solution. The presence of carbon dioxide in crystals of quartz is well known. Smoky quartz from Branchville, Conn., yielded gas, analyzed by A. W. Wright, which contained 98.33 per cent. of CO_2.

OTTO VEATCH

CONCERNING SEXUAL COLORATION

IN the linnet of California (*Carpodacus frontalis*), after the post-juvenal (first fall) molt, the sexes are conspicuously different in color. The female is obscurely streaked beneath with hair-brown on a dull white ground, above more uniformly hair-brown. The male is usually red in color, on the whole chin, throat, malar region and chest, on the frontal and lateral portions of crown, and on the rump; otherwise the male is like the female. The linnet would thus appear to provide a good case of "sexual coloration."

After the post-juvenal molt, there is, in both sexes throughout the lifetime of the individual, but one molt annually, taking place in August. *There is no pre-nuptial molt.*

In a large series of male linnets, leaving out the occasional aberrant examples which are distinctly yellow or orange, striking variation is shown in the shade and intensity of the red. Arrangement of the component examples by date, from September to July, shows this variation to parallel uniformly the lapse of time beyond the annual molt in August. In

[2] SCIENCE, N. S., XXIV., p. 694, 1906.

[1] Published with the permission of the state geologist of Georgia.