

or inner pores, those on the opposite sides being placed at right angles, thus producing a kind of maltese cross within each circle. This is very characteristic of the Palæozoic genus *Dadoxylon*, and your material cannot by any means have come from the Tertiary unless it has been redeposited. The specimen itself is Palæozoic, and the question of its possible removal from its original position is, of course, one of stratigraphy."

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NOTE ON A BREATHING GAS WELL.

A VERY remarkable gas well recently came under the writer's observation while engaged in studying the geology of the Santa Lucia Range. It is situated on the Eagle Ranch, on the eastern side of the Range in San Luis Obispo county, California.

The well is interesting on account of two things: (1), the presence of gas in the Golden Gate series, it being encountered while boring for water; and (2), the intermittent flow of gas, the periods of flow alternating with those of drawing in air.

The geology of this portion of the range is quite complicated. In the vicinity of the Eagle Ranch there are four different formations; the oldest, the Golden Gate series, consisting of shale, sandstone and jasper, with numerous ancient eruptives, the whole being probably of Upper Jurassic age. The rocks of this series are extensively developed through the Coast Ranges of California, but have never before been found to contain gas, nor have any indications of coal or oil been met with.

The well was bored on the point of a hill rising perhaps seventy-feet above a little flat on which the ranch buildings are situated; this flat is underlaid by Lower Cretaceous shales which surround the hill on three sides. The Chico sandstone occurs, overlying the shales in various places;

while to the east, some distance away, the Bituminous Slate series (Miocene) is met with filling the Salinas Valley. The Miocene is preëminently the oil and gas bearing formation of California. The writer does not know of any locality in the State where gas is obtained in quantities sufficient for use from beds of Cretaceous age, although such may be the case.

The well under consideration has a bore of six inches and was put down to a depth of three hundred and fifty-six feet. The strata passed through consists of shale and sandstone having a very steep dip. They are exposed on the south side of the hill at a distance of a little more than a hundred feet from the well, and exhibit the intense distortion of and shearing so characteristic of the Golden Gate series. When first bored, the water rose to within about eighty-five feet of the surface. A small amount of gas was encountered at a depth of ninety feet. Comparatively little gas came from the well at first, but during a stormy spell the well was pumped continuously for some time, and as the water grew lower a noticeable amount of gas began to issue. This increased until it was estimated to amount to twenty thousand feet per day. This state of things lasted for about six weeks, when the volume began to decrease, finally becoming intermittent. The well has now been opened for four years, the gas continuing to average about 250 feet per day. During settled weather the intermittent action is fairly regular, the gas issuing for about three hours, when an equilibrium being reached, the current changes and air is sucked in for the same length of time. If the air is not allowed to enter the gas will not flow; consequently an automatic valve has been placed at the surface of the well, permitting the ingress of the air. The suction is frequently so strong that, if only a small opening is left a roaring sound is produced, which is audible at the ranch house.

The gas issues also with a strong pressure. The amount of water in the well does not affect the flow of gas in any manner.

Whatever the cause of the intermittent action it is influenced by the varying pressure of the air, for before a storm, when the barometer is falling, the gas continues to issue for a much longer period, sometimes for 24 hours; and when the rise in the barometer takes place there is the same prolongation of the period of inhalation. During high barometric conditions the equilibrium may continue for some time. The well at the present time produces four to five thousand gallons of water per month, being pumped on an average about every two weeks. The locality is about twelve miles from the sea in a direct line, and has an elevation of 1,300 feet, so that it would seem impossible that tidal action could have anything to do with the phenomenon. During a talk with Mr. Benton, the superintendent of the ranch, who has closely watched the well, he stated that he had noticed no connection between the respiration and any physical conditions save the one referred to. The gas is used in all the ranch buildings, but is of such a character that with the ordinary burner it does not give a good light, consequently an incandescent burner is used.

The question of the source of the gas is rather a puzzling one. It hardly seems possible that it can be derived from the strata penetrated, and if not it must have its source in the surrounding Cretaceous shales, or possibly in the white Miocene shales, which here, as nearly everywhere else, are filled with animal remains. A well was sunk to a depth of 900 feet in the same area of Cretaceous shales about two miles miles to the west, but without encountering water or gas. If derived from the Miocene shales the gas must circulate through the rock for nearly three-fourths of a mile at least. The water is very pure, containing

no alkali or trace of oil such as might be expected if it has passed through Miocene strata.

As to the cause of the intermittent action no reasonable explanation has occurred to the writer, and it is left for physicists to explain. It is certainly not due to any of the connections on the surface, for the facts stated were observed prior to such connections.

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SOURCE OF X-RAYS.

NOTWITHSTANDING the considerable amount of attention the subject of Röntgen's discovery has received, there is a very wide diversity of opinion concerning the part of the vacuum tube at which they are produced. In view of the high reputation of the authorities who have expressed their decided opinions on this subject as experimenters and observers, it would be rash to advance the statements here made as being opposed to their own views. It is unquestionably true, however, that the evidence here given must be considered as demonstrating that *in this form of vacuum tube the X-rays radiate in all directions from the surface first encountered by the cathode rays*, and that they do not start from the anode.

Fig. 1 represents the vacuum tube. It is made of German glass tubing, 4 cm. in diameter and 8 cm. long. One end is drawn out, and an aluminum electrode terminating in a disc is inserted at A. A second is inserted in the side, at C, and is enclosed in a thick piece of glass tubing, to prevent any radiations from it reaching either A or B.

The end B has a flange which is ground to receive a ground plate of aluminum B. This plate is 3 mm. thick, except at the center, where it is ground away to a thickness of about one-tenth of a millimeter. The joint was made by melting shellac (containing a small quantity of rubber) around