ARTESIAN WELLS IN IOWA.

THE demand for artesian waters in the State of Iowa is not to be connected with unfavorable climatal conditions. The State is well watered; a considerable number of rather large streams and innumerable smaller ones combine to make it, from a hydrographic standpoint, unique among prairie States. The annual rainfall is a little more than thirty-five inches, and chiefly comes at a time of year when every crop-necessity is fully supplied. The main grounds upon which artesian waters are sought, therefore, are, first, the convenience of such flows for farm and urban use, and, second, the supposed purity of such waters. These are the prime reasons which have induced exploratory drilling, the chief results of which it is the purpose of this notice to record.

About four-fifths of the area of Iowa has now been demonstrated to possess artesian conditions. Most of this area lies northward of a line which may be drawn across the State, in a north-westerly direction, from near Keokuk to Sioux City, except in the igneous area indicated below. South of this somewhat arbitrary line but one or two artesian flows are known; these appear to be connected with the Nebraska artesian area, and are in the immediate neighborhood of the cities of Omaha and Council Bluffs. By reference to the sketch-map accompanying, it will be seen that the greater number of the wells lie along the DesMoines River or its tributaries; this distribution, which is well marked, is to be correlated with the distribution of the great terminal moraine, within which most of these wells are situated. This peculiarly interesting feature is further discussed beyond. The very deep and permanent artesian wells lie mainly east and north of the line above mentioned; or, better still, east of a line drawn north and south through the city of Ottumwa, No. 169 on the map. With but a single exception, that at Washington, No. 54 of the map, these deeper borings furnish abundant flows of water. But there are also, east of this north and south line, two smaller areas of shallow wells whose characters are essentially identical with those exhibited by the wells within the terminal moraine. One of these lies along the Iowa River (see map, Nos. 60–66, etc.); the other, and by far the smallest single artesian area in the State, is in the valley of the Wapsipinnicon River, in Bremer County (see map, Nos. 11, 12, and 42). The shallow wells, therefore, constitute well-defined groups; the deep wells are widely scattered.

It has been found convenient to classify the Iowa artesian wells in terms of the geological structure which they exhibit. To the shallow wells, those that form groups and which present similar geological sections, the term "glacial wells," or wells of the first class, has been applied. To all others, no matter what may be the geological age of the strata into which they may pass or in which they end, the term "deep wells," or wells of the second class, may be appropriated. There is no distinguishing mnemonic on the map, by which these wells may be differentiated.

A few important deep borings have been made, in various parts of the State, but more particularly in the north-western and south-western portions, in which artesian waters were not found. But, in the greater number of these borings, the water rose to constant heights, always, however, some distance below the top of the boring. These are called on the map "deep wells not artesian," and are indicated by a specific mnemonic, as in the Glenwood well, in south-western Iowa (see map, No. 120).

In depth the glacial wells range from forty feet to two hundred and fifty feet in a few cases; this feature is dependent on the relations of the borings to pre-glacial drainage, on the one hand, and to the thickness of the morainic materials, which is a variable, on the other. A generalized section may be given as follows from the sequence disclosed in Hancock and Wright Counties:—

Soil	1–5 feet.
Bowldery clay, with water	10–50 feet.
Bluish, bowldery glacial clays	30–12 feet.
Sand and gravel	8–20 feet.
Sand and gravel, with water	15–25 feet.

These materials are irregularly distributed over the surface of the State, and exhibit a variable relation. However, whenever the gravels and sands of the lower series are reached, especially in the valleys of the larger streams within the terminal moraine, flowing wells are likely to be obtained.

The deeper artesian wells, or those which present the characteristic feature of penetrating the country rock, are typified by the following section, which is that of the deep artesian well at Cedar Rapids:—

No.	Feet.
1. Dark-gray limestone	50
2. Light-gray limestone	85
3. Gray limestone	40
[1] 4. Coarse-grained, reddish-brown limestone	65
[1] 5. Coarse, brown, and very porous limestone	60
6. Coarse, light-brown limestone, mixed with shale	30
7. Shale	20
8. Coarse, dark-gray limestone	25
9. Coarse, light-gray limestone	45
10. Tough, blue clay	200
11. Reddish-brown sandstone	205
12. Shale	5
13. Dark, bluish-gray sandstone	65
14. Shale	1
15. St. Peter's sandstone	50
16. Gray sandstone	74
[1] 17. Brownish sandstone	40
[1] 18. Coarse-grained, porous, brown sandstone	270
19. Light sandstone	88
20. Dark-colored and hard sandstone	42
21. Brown, very close-grained and hard sandstone	140
22. Blue clay	100
23. Soft, reddish-brown sandstone	160
24. Potsdam sandstone	200
25. Red sandstone	75

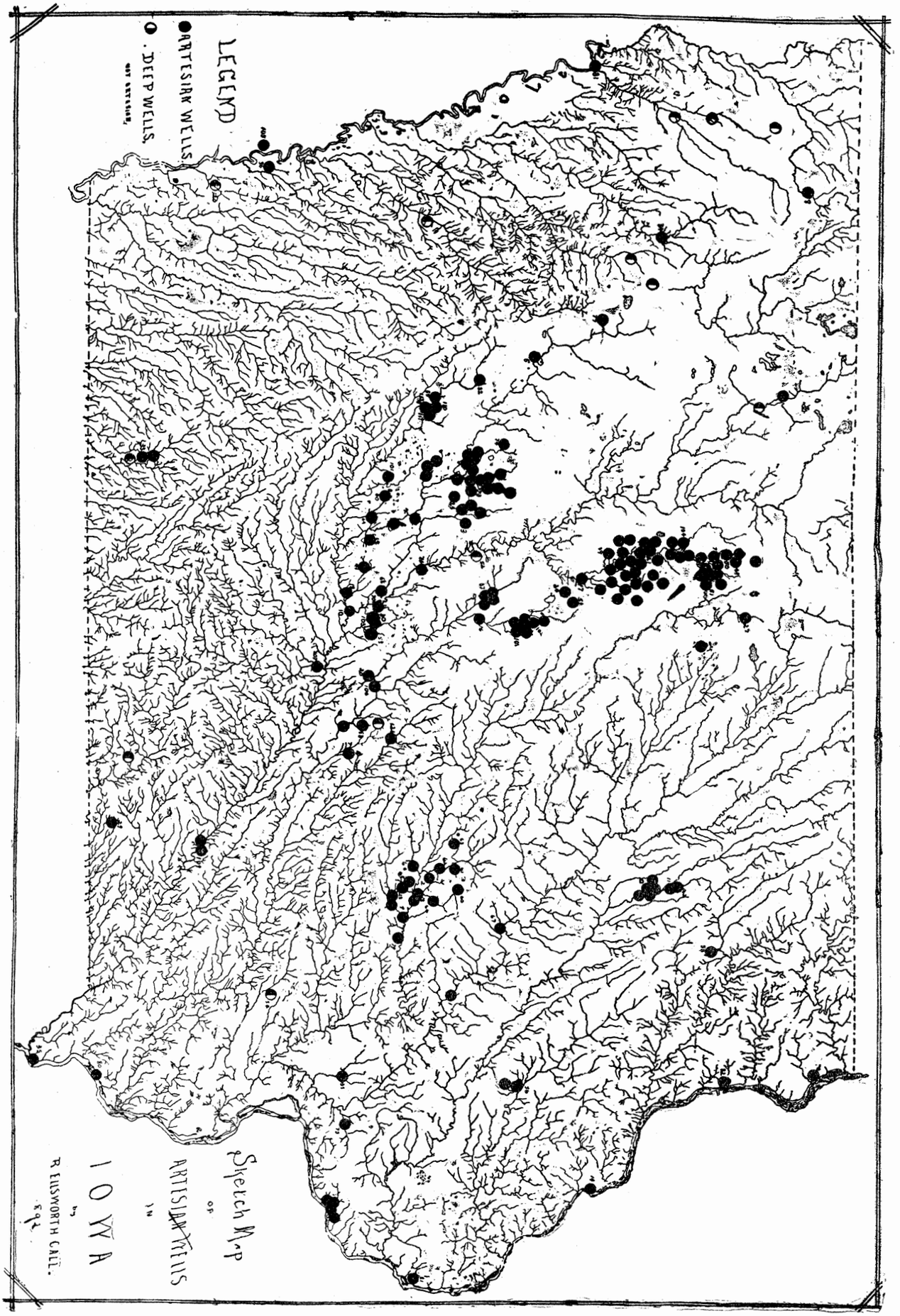
[1] Contains water.

Over the eastern third or more of Iowa, east and north of the line drawn from Keokuk to the vicinity of Sioux City, as above mentioned, thence north-easterly to Worth or Mitchell Counties, the St. Peter's Sandstone may be reached in deep wells, and flowing water found. North of that part of the line which extends north-easterly from Sioux City flowing water will not be found, if the indications of the strata penetrated in the Hull, Sioux County, wells are reliable. From that place igneous rocks, presenting a volcanic facies, have been submitted to us.

The south-western part of the State, that is, all that part of Iowa which lies south of the first arbitrary line above indicated, will not furnish artesian waters. The section, which is given elsewhere, of the Glenwood deep-boring furnishes the most complete vertical section of the carboniferous rocks, which is exhibited in Iowa. It further affords no hope that artesian waters will be reached at reasonably profitable depths in that portion of the State.

Readers of *Science* who may be interested in the details of an investigation, of which this notice is a brief abstract, may receive the full paper on addressing the Iowa Weather and Crop Bureau, DesMoines, Iowa, under whose auspices the work has been done.

E. ELLSWORTH CALL.


LEGEND
ARTESIAN WELLS.
DEEP WELLS.
Sketch Map
OF
ARTESIAN WELLS
IN
IOWA
BY
R. ELLSWORTH CALL.