son, they have no cause to fear him. Such precautions as that of taking the animals out in a boat so that they may be killed over water seem rather absurd, the more that when pressed by hunger they will even devour the skinned bodies of their own species. One piece of information desired, as to whether or not the foxes would wander off on the ice floes when they were being fed, has not yet been obtained because, curiously enough, during the two years that the experiment has been made the ice has not happened to touch St. George.

Incidentally Mr. Judge has made observations on the food, size and condition of foxes, and has shown that the pelt does not improve with age, as has commonly been stated, but that the yearlings and two-year-olds have the best fur. As for weight, the smallest fox weighed a little over eight pounds, the largest a trifle more than fourteen, the great majority weighing in the vicinity of ten pounds.

The outcome of these experiments will be awaited with much interest, and if by a little artificial selection and environment a naturally monogamous animal can be rendered polygamous, the supply of blue fox furs will be materially increased.

The table appended gives the results of the catch for the season of 1898–99, and the total number of animals must seem rather surprising to one familiar with the island.

It only remains to add that the greatest number taken in any one evening was 245, of which 61 were killed; the second best night's work was 211, and of these 57 were killed.

Foxes taken on St. George during the season of 1898–99:

Male Blue Foxes trapped and killed	334
Male Blue Foxes otherwise killed	34
White Foxes killed, males and females	18
Male Blue Foxes trapped and released	110
Female Blue Foxes trapped and released	389
Total	885

F. A. Lucas.

THE DEEP WELL AT WILMINGTON, N. C.

The deep well which is now being bored at Wilmington, N. C., is of especial interest to geologists: (1) That in reaching granite, as it does at about 1109 feet, it shows the absence at this point of formations between the upper Cretaceous and the old crystalline floor underlying the coastal plain deposits; (2) it shows the existence there of an unfortunately and unusually thick series of salt-water-bearing strata, from 350 to 1100 feet below the surface; (3) it may throw some light on the relations between the deposits of the sand hill regions (generally classed as Potomac) and the upper Cretaceous beds penetrated by this well.

The well is located on the bank of the northeast Cape Fear river, at Hilton Park, one mile north of Wilmington. The river border at this point exhibits two terraces; one only a few feet above tide water, extending back a distance of 30 or more feet from the river; and the other rising 30 to 40 feet higher, extending back for a considerable distance, and indeed representing the general surface of the region. The difference in elevation between these two terraces represents the thickness of the remnants of the Tertiary fossiliferous clays and limestone and the overlying recent sands. The lower terrace represents the upper surface of the Cretaceous; so that the well starts in the Cretaceous clays and sands, and continues in them to a depth of some 1109 feet. In these sands and clays there are occasional beds of shell-rock and calcareous sandstone varying in thickness from a few inches to 30 feet, and occasional thin beds of clay containing small nodules or concretions. The sands are mostly micaceous and are usually quite fine grained, with a prevailing gray color. From about 700 to 800 feet, their color is decidedly greenish. Below 950 feet these sands become coarser and are interbedded with occasional gravel deposits,

but they continue fossiliferous to near the surface of the granite.

Waterbearing sands and gravels were penetrated at a number of points, notably at 380, 496, 520 and 574 feet; and at 1011 the largest flow, of nearly 400 gallons per minute, was encountered, with pressure estimated as sufficient to raise the column of water 80 feet above the surface. Unfortunately the water from each of these levels was highly brackish, and hence unfit for domestic use.

The fossil forms secured at different depths have been identified by Dr. T. W. Stanton, of the United States Geological Survey. The method used in sinking the well is the ordinary drill and sand pump; and, as might be expected, in some cases only fragments of shells were secured; but as the hole was of large diameter (12 inches near the surface, then 10 inches, and lower still, 8 inches) and the larger part of the matrix material quite soft, a minimum amount of drilling was needed; and many large fragments and many perfect forms were obtained.

Among the fossils secured from the upper 700 feet, classed as Ripley cretaceous, the following may be mentioned:

Cardium eufaulense Gabb, was found at 40 feet and 538–558 feet, and fragments of this or another Cardium were found also at 50, 485–490, 520–540 and 556–575 feet below the surface.

Anomia argentaria Morton, was also common, having been obtained at frequent intervals from 40 to 600 feet; and fragments of an *Anomia*, too small for specific classification, were also found 800 to 900 feet below the surface.

Exogyra costata Say, was abundant throughout the upper half of the section; and below 500 feet a varietal form of this species, approaching *Exogyra ponderosa* Roemer in surface feature, was found almost to the granite.

Ostrea tecticosta Gabb, was common from 230 to 650 feet; and *O. larva* Lamarck, from 250 to 330 feet; and fragments secured at 518 feet probably belonged to one of these species. *O. subspatulata* Lyell & Forbes, was found only between 332 and 380 feet. Throughout the entire section, however, were found numerous fragments of *Ostrea* too imperfect to serve for specific determinations. *Veleda lintea* Conrad, and *Aphrodina tippana* Conrad (?) were found only at 340 to 500 feet. *Baroda Carolinensis* Conrad, and *Cyprimeria depressa* Conrad, were found only between 332 and 380 feet; and fragments of *Pecten* were found at 40 to 50 feet.

Gryphaea vesicularis Lamarck, was found at 250 to 265, and 720 to 735 feet (?); and *Inoceramus cripsii* Mantell, at 575 to 585 feet and probably also at 500 to 518 feet. Unrecognized species of *Avicula* or *Gervillia* were obtained at 390 to 400 feet; *Corbula* at 492 feet; *Pectunculus* 520 to 540 feet, and *Lunatia* 520 to 590 feet; *Lithophagus* 540 to 560 feet.

Cassidulus subquadratus Conrad, was observed at 518 to 538 feet, and echinoid spines and fragments of the same or allied species were also found at 100 to 170 feet. Sharks teeth, fish vertebræ, fragments of turtle shell, lignite and pyrite were found at intervals in the section.

Below 720 feet, and down to the granite (1109 feet) *Ostrea cretacea* Morton, which in the Chattahoochee river section is confined to the Eutaw beds, is here quite common; and is accompanied at intervals by *Anomia Exogyra*, *Cardium* and *Serpula*, the specimens collected being in each case too fragmental to permit of specific determination. This lower 400 feet of the Wilmington section has been classed by Stanton as *Eutaw*; and it is possibly the seaward representative of the Potomac arkose sands and clays of the sand-hill region northwest of Fayetteville, should these sands and clays prove to represent the latest Potomac. It is more

likely, however, either that the Potomac deposits were removed from this region prior to the Eutaw deposition, or else that the surface of these old crystalline rocks was above water level during Potomac time, and hence not covered with deposits.

Underground temperatures were not taken at intervals at different depths while the work was in progress, owing to the lack of suitable thermometers; but there are now three wells only three or four feet apart, one 1100, one 500 and one 100 feet deep. The temperatures at the bottom of each of these, as determined by the use of a Darton deep well thermometer, were found to be 79°, 72.50°, and 68.50°F. respectively, giving a descending increase in temperature of about 1°F. for each 100 feet, between 100 and 500 below the surface; and 1°F. for each 98 feet, between 500 feet and 1100 feet below the surface.

J. A. Holmes.

Chapel Hill, N. C.

GRANITES OF THE SIERRA COSTA MOUNTAINS IN CALIFORNIA.

The Sierra Costa mountains occupy mainly the northeastern and northcentral portions of Trinity county, in northwestern California. They are the loftiest and most scenic portion of the Klamath mountain system, an off-shoot of the Sierra Nevadas. They consist, in general, of highly metamorphic clastics and ancient igneous rocks, including a basement crystalline formation, a massive serpentine, and a series of micaceous, chloritic, graphitic and hornblendic schists. All these are pre-Carboniferous in age; they have been subjected to intense orographic disturbance, folded and faulted on a grand scale, and into the fissures have been injected various granitic and dioritic dike rocks. Of these, granite, in hugh batholites, is by far the most important and bulky.

Three principal types of granite are represented, and they present some interesting contrasts: hence this paper.

On the western side of the head-water portion of the south fork of the Salmon river in Siskiyou county, there is a huge white mountain of nearby bare granite—Mt. Courtney of the Cariboo range. It is a massive batholite of true granite, consisting of large individuals of quartz, white feldspar and dark brown biotite, *but little or no hornblende.* It is very coarse-grained, the three rock species being crystallized on a scale of one-fourth inch. The color is a very light gray, as a soda-feldspar is a predominant constituent.

The Courtney granite abounds in vein-like dikes of aplite, a much finer grained white granite, in which the biotite is in small foils and sparingly developed. The contrast between the massif of very coarse-grained granite and the included dikes of fine-grained aplite is strong. Evidently they both represent the same magma, but it seems that after the coarse granite mass had solidified in its upper portion, great fissures were formed in it and the aplite arose in them, solidifying to form the curious dikes of white granite. The former is coarse-grained, because, being in one great mass, it cooled slowly, and the latter is fine-grained, because, being in thin dikes widely scattered through an already solid rock, it cooled rapidly.

Near the contact between the Courtney granite and the hornblende schists on the east, both granite and schist are cut by dikes of a white muscovite granite, a kind of fine-grained pegmatite. This contains neither biotite nor hornblende, and is more resistant to weathering influences than the other granites of this area. These pegmatite dikes are cut by a transverse system of dikes of dark green diorite-porphyrite, which also occurs in the coarse-grained biotite granite of Mt. Courtney, as well as dikes of very fine-grained light greenish gray diabase.

On the east side of the head of south fork