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

of Salmon river, about three-fourths of a mile distant from Mt. Courtney, there is another granite batholite but it is composed of an entirely different type of granite. It contains the ordinary quartz, feldspar and biotite, but in addition, *it abounds in well-formed crystals of dark green and black hornblende.* The feldspar being largely plagioclase, it is a quartz-mica diorite, although its general appearance in the field is distinctively that of a granite. In fact, it is the rock commonly designated, by students of the Sierra Nevada region, granodiorite. It is finer grained and a darker gray in color than the Courtney granite.

This massif of granodiorite is at least a mile in length and one-half mile in width. It is one of a series of such granite masses scattered through the Sierra Costa mountains eastward from Mt. Courtney, some of which are as much as three miles in width. They all contain the large constituent of hornblende, and are characterized by spots of darker color, like included boulders of diorite-porphyrite, but which are probably concretionary in origin.

It is difficult to comprehend how such great masses of granite could be injected into the stratigraphic series, displacing the strata for miles. Mt. Courtney is but one of a series of high granite peaks extending southwest from it and apparently consisting of the same great massif of coarse-grained biotite granite, which may be ten miles or more in width. The strata of serpentine and schist must have been forced apart and up into high mountain masses, of which even Mt. Thompson, altitude 9345 feet, is but an insignificant remnant.

Between Mt. Courtney and the massif of granodiorite about three-fourths of a mile east of it, there is a block of mica and hornblende schists wedged in between the two granite masses. This dips steeply eastward, away from the Courtney granite and toward the granodiorite. As it approaches the latter it becomes nearly vertical, but the strata are cut off by the granodiorite. The contact is finely exposed and shows no contact metamorphism. The dark green hornblende schists are absolutely unchanged to the very contact. Fragments of all sizes up to 100 cubic feet, of the hornblende schist are included in the granodiorite from the contact in places, 100 or more feet distant. Some portions of it are a veritable breccia of schist cemented by granodiorite.

Now, the edges of all fragments are sharp and the corners angular. Nowhere is there the least evidence of partial fusion of the schist material even along the edges, by the heat of the great mass of 'melted' granodiorite in which it had become included. If the latter was *very* hot, it appears evident that during the long time which such a great mass must have required in cooling, the hornblende and quartz, of the schist fragments must have partially fused. The failure of this to occur to even the slightest degree, implies, in my mind, that the granodiorite was not very highly heated—not nearly so much so as other dike rocks of the same region. Yet that it was in a highly liquid condition is proved by its injection into the finest cracks of the adjoining schist. In short, I believe there is here abundant evidence to demonstrate a perfect fusion without great heat, a sort of 'wet fusion,' we may suppose, due to the presence of heated alkaline waters. The fragments of hornblende schist were impervious to this water, the heat not sufficient to produce a 'dry fusion,' and hence the present phenomena, described above. As this locality may prove a very interesting one to students of igneous geology, I will give it as the vicinity of Lake Catrina, on the mountain ridge just east of the head of the south fork of Salmon river.

The age of all the granites of the Sierra

Costa mountains is practically the same. They belong to a period of orographic disturbance during which the intrusives were predominantly granitic in distinction from an earlier diabasic and a later dioritic period of igneous activity. This granitic period was post-Carboniferous and pre-Tertiary. To make a finer distinction, many of the granodiorite dikes can be demonstrated to have been formed after the Mariposa slates of late Jurassic age (which they cut), and before the Shasta-Chico shales and sandstones of late Cretaceous age (which lie upon their eroded surface).

An interesting problem yet to be worked out is the relation between the biotite granite of Mt. Courtney and the granodiorite of the mountain country to the eastward. Why two such strongly contrasted granites of apparently about the same age and mode of formation should occur in such close juxtaposition as the Courtney and Catrina batholites on opposite sides of the valley at the head of the south fork of Salmon river, is to me a puzzling problem and one well worth considerable study.

Oscar H. Hershey.

AMERICAN PSYCHOLOGICAL ASSOCIATION.

The eighth annual meeting of the Association was held at Yale University, December 27th–29th, in affiliation with the American Society of Naturalists. In point of numbers and activity the meeting was one of the most successful in the history of the Association. Professor John Dewey, of Chicago, the President of the Association, was present in the chair, and on the afternoon of Wednesday, the 27th, read his presidential address on 'Psychology and Social Practice,' in which he discussed the relation of psychology to education considered as a form of social practice with which psychology might be expected to have most immediate concern, and then generalized the results reached to draw certain conclusions regarding the general value of psychology as a method to be applied in social life. (The address will appear in full in the March number of the *Psychological Review.*)

Following the address a formal discussion on 'How should psychology be taught?' was opened by Professor Fullerton, of Pennsylvania, who laid particular stress upon the question of the adjustment of the relative claims of the so-called 'new' psychology or psychology of the laboratory and the 'old,' which depends largely upon introspective analysis. He emphasized the necessity of both aspects in a general course, as well as the danger of giving undue prominence to either, and particularly, in America, to the experimental, owing to the tendency to extreme specialization in the subject in this country. Professor Fullerton further discussed the attitude which the university should take toward advanced students in the light of their future work. Professor Jastrow, of Wisconsin, continued the discussion and urged the importance of what he termed a 'functional' psychology in teaching, having the student verify facts and principles from his own experience, so far as possible from his own daily mental processes. He showed further the great value which experimental experience has for the introspectionist and agreed with the former speaker in deploring the quasi-antagonism of the two sides, arguing that both experiment and introspection are necessary and that they are complementary and in no way antagonistic. Professor Aikins, of Western Reserve, followed with a statement of the results of his own experience in teaching the subject, and described his method of combining experiment and textbook with collateral conferences. Professor Judd, of New York, closed the formal part of the discussion by calling attention to the peculiar difficulties encountered by the stu-