Correspondence.

The Origin of the California Coast Mountains.

To the Editor of the Scientific American:

During the meeting of the American Association for the Advancement of Science, it was interesting to observe the different opinions held by geologists respecting the geological changes that were brought about during the glacial period. Some of the members declared that they did not believe that glaciers have ever been an important geological agent, and that the phenomena usually ascribed to glacial action in the record of an ice period were generally due to icebergs. While, on the other hand, others asserted that during the glacial epoch heavy ice sheets covered most of the elevated portions of western North America, as far south as the 36th parallel of latitude; and that eastern North America was overspread with ice, which attained a depth of between five and six thousand feet. This last declaration supports the views of Professor Hitchcock and others, who believe that the ice sheets of New England were able to move their debris over wide lands of little declivity toward the sea; their immense deposits forming the lands of Cape Cod, and also the large islands of Nantucket and Martha's Vineyard. Glacialists also maintain that even greater work has been performed by ice sheets in other countries.

Professor James Geikie states, in his discussion on the glacial deposits of northern Italy, that the deposits from Alpine ice sheets of a frigid period, "rise out of the plains of Piedmont as steep hills, to a height of 1,500 feet, and in one place to nearly 2,000 feet. Measured along its outer circumference this great morainic mass is found to have a frontage of 50 miles, while the plain which it incloses extends some 15 miles from Andrate southward." As the foregoing statements represent only a few of the great geological changes declared to have been brought about during past ice periods, I am prompted to offer my views on glacial work performed on a portion of the Pacific shores of our country, which seems to me to have been much more extensive than hitherto supposed.

Professor Whitney describes the Coast Mountains of California as being made up of great disturbances, which have been brought about within geologically recent times. And this statement I found to be so obvious, while journeying in that region, it appeared to me that the Coast Ranges originated in a different manner from the older Sierras. The western sides of the latter mountains everywhere showed the great eroding power of ancient glaciers; and when I considered their favorable position for the accumulation of snow during a glacial period, I was led to seek for the glacial deposits adequate to represent the great gathering of ice which an age of frigid temperature would produce. But it seemed to me that such deposits could not be found in the foot hills of the Sierras, which contain the moraine of inferior ice sheets that terminated at the base of the mountains. Under these considerations I came to the conclusion that during the earlier ice periods the immense glaciers which formed on the western slopes of the Sierra Range moved their gigantic heaps of debris so far seaward as to form the range of hills now existing next to the coast-line; the Contra Costa, or middle, range being formed during a subsequent ice period in the same manner as the hills next to the coast line. Still, it may be that neither of the Coast Ranges was the work of a single ice period, but the western range must necessarily have been the earliest deposit.

Although the Sierras differ from the coast hills in composition, it does not disagree with the glacial origin of the latter region, from the fact that the ice sheets while moving their bulk westward displaced the deposits of such bays, lakes, rivers, and marshes as lay abreast the Sierra slopes; the moving ice sheets, thousands of feet in depth, pressed and plowed below the somewhat superficial Cretaceous and alluvial strata which lay in their course. The disturbed strata, while pushed along in confused heaps in front of the ice, were amassed in ridges sufficient to form the hills of the Coast Ranges. The bowlders found embedded in several of the coast hills must have been moved by ice from the Sierras, on account of the Coast Ranges not having a rocky core of sufficient firmness to give shape to such bowlders. Moreover, the temperature of the Pacific waters would not be favorable for glaciers to form on the Coast Ranges with the ice sheets of the Sierras terminating at the foot hills.

The Sacramento and San Joaquin valleys are now covered by recent river deposits, therefore the glacial drift which should be traced from the Sierras to the Coast Ranges is concealed. But the abraded appearance of exposed solid rock at the base of the foot hills, and also the scattered bowlders which gradually disappear beneath the diluvial deposits of the plains, indicate that the Sierra ice sheets could not have ended at the foot hills, but must have moved further westward while pushing immense accumulations of earth in their front. The Coast Ranges in several places have been subject to igneous action, which may have been brought about through heat generated from pressure exerted on the interior masses after the ice had melted away; the heat thus produced being sufficient to cause outbursts of lava, where the nature of the material favored combustion. The low plains, lakes, and bays which separate the Sierras from the coast hills are in a position similar to the shallow sounds which separate Nantucket, Martha's Vineyard, and Long Island from the inferior slopes of the mountains of New England. Therefore, while agreeing with glacialists who believe that great geological changes have been wrought by ice sheets in Italy and New England, it appears to me that the ancient glaciers of Sierra Nevada have accomplished far greater work, owing to the Sierras being situated in a more favorable position to receive and condense the humidity from the ocean. Hence, with a low temperature vast quantities of snow would gather on their lofty sides, and at the same time their longer range and greater declivity would cause the ice sheets to move down their steeps with greater force than the glaciers which passed over New England.

C. A. M. TABER.

Wakefield, Mass., January 4, 1884.

Screw Threads and Nuts.

To the Editor of the Scientific American:

Some fourteen years ago, while experimenting with materials for armor plating, I became convinced that the standard V-shaped screw threads were very much too coarse, not only for armor plating, but for nearly all mechanical purposes, and that the sizes of nuts were out of all proportion to the strains required to break the corresponding bolts.

A brief statement of these facts was inserted in Professional Paper No. 17, Corps of Engineers, printed in 1870; but my attention was diverted to other duties before I had a chance to test the matter experimentally, and it was not until last month that a convenient opportunity occurred.

Having occasion to use a large number of bolts in building iron lock gates for the Muscle Shoals Canal, I had four test bolts made, two of which had the standard threads of six to the inch, and two with double that number. They were made of the same quality of iron, forged at the same time, and no special care was taken in fitting the nuts. The shanks of the bolts were turned and the heads and nuts were finished up in the usual way. The heads were only $1\frac{5}{8} \times 2$ inches square, and the nuts were the standard size for $1\frac{1}{4}$ inch bolts, or about 60 per cent of the weight adopted for $1\frac{1}{2}$ inch bolts, which was the size to be tested. The outside of the thread was reduced one-twentieth of an inch smaller than the shank of the bolt, to prevent injury to the thread in driving the bolts to their places.

These bolts were carefully tested on the great machine at the Watertown Arsenal under direction of Major F. H. Parker, U. S. Ordnance Corps, and there was not only no sign of stripping the thread or splitting the nut in any case, but the bolts with fine threads stood an average of 78,400 pounds, while the coarse threaded ones broke at 66,325 pounds. The shanks of the bolts, which were 7 inches long, were stretched over $4\frac{1}{2}$ per cent in case of the fine threaded bolts and only 2 per cent in case of the coarse ones; which shows that the "work" of breaking the former was more than two and a half times as great as in case of the standard bolts.

The tensile strength of the iron was found to be 59,785 pounds per square inch in the coarse threaded bolts, and 58,495 pounds in the fine ones; which shows conclusively that the foregoing results are due entirely to the additional cross section secured by using the fine threads.

It is by no means doubtful that even better results can be obtained by adopting still finer threads, as 16 or 18 to the inch would not be likely to strip, unless very badly fitted or worn out by frequent turning on and off, in which cases a coarser or a different form of thread is necessary.

In most cases, however, it is evident that a *net saving of at least twenty per cent* can be made *by using a finer thread*, which is absolutely easier to cut than a coarse one, and *forty per cent can be saved by making* the *head* of the *bolt* and *nut* that much lighter.

W. R. K.

Chattanooga, Tenn., January 3, 1884.

Acoustic Vibrations.

To the Editor of the Scientific American:

The experiment here described, though containing nothing new to those familiar with the principles of acoustics, may be of some interest to a class of your readers who are students of this science, especially as I doubt not it is something not very often occurring on such a scale, in even the most noted laboratories of the country.

In illustrating the longitudinal vibrations of rods and tubes, I held firmly in one hand, at about the middle, a large glass tube, and rubbed it back and forth with a wet woolen cloth held in the other hand. The sound produced was quite loud and piercing, and was of itself sufficient to excite the interest of a large class seated before me. So energetic, indeed, was the vibratory motion that I felt rather apprehensive for the safety of the tube. Suddenly a sort of crash came, just *below the hand* that held it, and the tube for a length of nearly three feet was shivered to many pieces. The fragments were, I suppose, of a mean length of two inches, and the tendency was to break into rings somewhat approaching the wave-length of the vibrations constituting the sound emitted.

The tube was above 6 feet long, about 2 inches in diameter, and the glass more than an eighth of an inch thick. It will be seen from these dimensions that it was quite a stout pipe, and the effort to break it with the hands, even across some point as a fulcrum, as the knee, would have involved the exertion of a great deal of strength. Yet there was very little muscular strength exerted, and that not directly against the strength of the material. Moreover, the shattering occurred in the half *below* the hand, and was not of the part rubbed by the cloth.

J. F. B.

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The Tidal Wave of Earthquakes.

M. Ferdinand de Lesseps has communicated an interesting note on this subject to the French Academy of Sciences. On the 27th of August last, after 4 P. M., the sea level at Colon, on the Atlantic side of the Isthmus of Panama, began to oscillate, as shown distinctly by the marigraph of the Inter-Oceanic Canal Company. In amplitude the oscillations equaled the usual tidal rise, but succeeded each other at intervals of one and one and one-half hours instead of 12 hours, as in the case of the normal tides. The curve of the marigraph showed that between 3:30 P. M. and 1:30 A. M. the sea oscillated eight times with a rise of from 0·30 to 0·40 meter. The movement began with an ebb of the water, as if a hollow had been made in the sea, and gradually diminished after 1:30 A. M. on the 28th, till 11 P. M. on the succeeding night. M. De Lesseps can connect this phenomena only with the volcanic eruptions in the Straits of Sunda, near Java, which began on August 25th, and reached their height during the nights of the 26th and the 27th of August. The island of Krakatoa disappeared under the water in the west entrance of the straits. The maximum tidal disturbance at Colon lasted ten hours, and began on the 27th at 2:30 P. M., which, allowing for difference of longitude between Sunda and Colon, corresponds to 4 A. M. on the 28th. The time of propagation of the aqueous disturbance is therefore thirty hours. Curiously enough, no such disturbance was registered on the marigraph of Panama, on the west side of the isthmus, although there is a straight sweep of ocean to Sunda, whereas to reach Colon the wave would have to turn round the African continent, surge up the South Atlantic Ocean, and penetrate the Caribbean Sea. But M. De Lesseps explains this anomaly on the supposition that the innumerable islets and coral reefs to the north of Australia would break the force of the waves in traveling to Panama, whereas in the deep water of the Great Ocean it would continue to propagate itself, and follow the line of the great equatorial currents round Africa and into the Gulf of Mexico.

While upon this subject we may mention, says *Engineering*, that the tidal waves occasioned by the eruption in question have committed serious damage on the low coasts of Java and Sumatra. The French coast marigraphs at Rochefort, Socoa, Fort Boyard, Cherbourg, and Havre also showed traces of the tidal disturbance mentioned by M. De Lesseps. Taking the times of these tidal waves and those of the great shocks at Sunda, M. Bouquet de la Grye calculates that the speed of the tidal waves was about 305 miles per hour. Other data from the marigraphs of Mauritius give the speed at 186 miles per hour and 362 miles per hour, the latter being a more correct estimate. The length of a wave at a given moment is reckoned at 376 miles. The Straits of Sunda are in rough numbers 12,600 miles from the coast of France.

Effect of Climate on Railroad Ties.

At a recent meeting of the Institute of Civil Engineers for Ireland, a paper was read on "Railroad Ties in Mexico," from which we extract the following: "The sleepers used are nine feet long, ten inches wide, and five inches thick. The selection of suitable wood for sleepers has occupied much attention. Good, well creosoted Baltic sleepers have been tried on a large scale, and found to become decayed and useless at the end of about four years. Hard, strong oak sleepers, obtained in the country, have also been tried in large quantities, and found not to last more than three or four years. The timber of both the Baltic and oak sleepers seemed to undergo a rapid change and become quickly converted into a dry, spongy consistency.

There was no appearance of insect ravages; the timber had evidently not been able to withstand the great heat or dryness of the atmosphere. The best wood yet discovered for sleepers is zapote. It is essentially a tropical timber, and is exceedingly durable for outdoor or indoor work above or below ground. Samples of this wood taken out of buildings said to have been erected more than two centuries ago did not show the slightest signs of decay; the wood was as sound as the day it was put into the building. This wood, however, is very scarce and very expensive. In color it is nearly as dark as logwood. It is very heavy and sinks in water, and is so hard that the boring of the holes for the spikes and forming the grooves for the rails is very laborious work. It appears to be almost impervious to decay, but it has a tendency to split if exposed to the heat of a tropical sun for a few months. For this reason the zapote sleepers must be kept equally covered with ballast.

The next best quality of timber yet found in the country, and of which by far the greater number of the sleepers on the line are made, is sabino, a species of cedar. The general color of the wood is either a light yellowish brown or a light pink, and in appearance is very similar to the cedar used for ordinary lead pencils. It is a resinous wood, with a peculiarly fragrant odor, and is straight grained, readily worked, and does not appear to be attacked by any insects. In many of the very old buildings on the upper plains, beams and posts of this timber are still standing, and show very little signs of decay. For sleepers it is very durable, and those that have been down for several years indicate that they are more likely to give way from the actual wearing or cutting in of the rail flange than from natural decay."