

diets are useful for studies with such animals as rabbits, guinea pigs, sheep and goats because one substance at a time can be added to or subtracted from such mixtures. The development of such diets for white rats about 20 years ago led to many of the modern discoveries in the science of nutrition concerning vitamins, minerals and proteins. With these new diets such studies will become possible with herbivorous species. These species include the foster mothers of the human race, the cow and the goat, as well as sheep. They also include the smaller animals such

as rabbits and guinea pigs which are widely used in laboratories for the study of disease.

The "synthetic" sheep proved to be in excellent condition and free from one of the most common of the parasites which are found in almost all the sheep of the region. From observations upon these animals it is thought that these new diets may afford novel methods of freeing sheep from the usual parasites that inhabit the digestive tracts of sheep.

*Science News Letter, November 17, 1934*

OCEANOGRAPHY

## Amazing Landscape Lies Beneath the Pacific Ocean

If the Water Could be Drained from California Coast Scenic Marvels Would Be Revealed to Onlookers

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IF SOME force could remove the waters of the ocean to a depth of two miles, residents of Monterey peninsula, on the California coast, could look out onto one of the scenic marvels of the world.

Directly off Pacific Grove they could look down a canyon wall to a floor 7,000 feet beneath their level and they could see a 5,000-foot wall rising on the farther side. If they were standing at the end of the peninsula, they could see another impressive canyon coming out of the present Carmel Bay, receiving many tributaries along its course, to where it joined the main Monterey Bay canyon.

The fishermen who inhabit the sparsely settled coast around Cape Mendocino, in northern California, would see a series of canyons directly off their homes that would compare to the greatest valleys of the west slope of the Sierra Nevada.

The residents of La Jolla, near San Diego, would be given a surprise through the appearance of a deep chasm with almost vertical walls, which would be seen extending out from the present day sea cliffs north of the Scripps Institution of Oceanography. Gorges such as this would become the show places of the new California coast.

It is natural to be curious about the

origin of these remarkable gashes in the sea floor. There is no evidence that would allow us to believe that these great rock canyons could have been cut out of the sea bottom by the feeble currents of the deeps. Neither do they contain the basin depressions cut by unusual marine currents in such places as the Golden Gate, where the tide is accentuated by the narrowness of the entrance and the vast size of the bay. These canyons were more likely produced by some process now observable on land.

There are three main types of deep land valleys: those excavated by the ice, of which the Yosemite Valley is a classic example; those cut by rivers, of which the Yellowstone Canyon is typical; and finally those due to faulting of blocks of the earth's crust, of which Death Valley and Owen's Valley in California are splendid illustrations. Each of these types has definite characteristics, as you will know if you are familiar with the examples cited.

Of the three the river-cut canyons are the most distinctive as they have a rough V-shaped cross section in contrast to the U-shape of the glacial valleys and the trough shape of the fault valleys. Also most of the river valleys are much more winding in their courses than the others, and have tributary systems very much like the branches of a tree or the veins of a leaf.

When we compare these charac-

teristics of deep stream valleys with those of the submarine canyons we find decided agreement, and the new surveys seem to leave little doubt but that the great canyons of the sea floor were excavated by ancient rivers at a time when the land margins were greatly elevated.

The significance of these deeply submerged river canyons off the California coast is a cause of bewilderment. It has been generally assumed by geologists that the California coast is rising. It undoubtedly has risen, as anyone can see from the marine shells in the gravel deposits on the numerous beaches now well above sea level. Why then do we have on the one hand these submerged river valleys as evidence of a rising coast? The difficulty is removed by the assumption that there was first a large subsidence which drowned the canyons and later a more moderate uplift which raised the narrow wave-cut benches.

The straightening of the California coast and the cutting of wave terraces following the submergence of the canyons must have consumed a long period of time and therefore the submergence must have been very remote. There are reasons to believe it occurred more than a million years ago.

Comparisons between old and new marine surveys have to be made with care and used with reservations; but such comparisons off the California coast at least strongly suggest that there have been changes in depth during the last 50 years. Such changes were inferred in the submarine canyons off Redondo, off Newport, and off Carmel. In each case the new surveys give evidence of decided deepening. It seems probable that the canyons despite the usual slow filling with sediments are deepened from time to time by these mud flows.

The submarine canyons are of some practical importance to man. They allow navigators to determine definite positions at sea during a fog. They constitute good fishing grounds because of the rocky ledges on their sides. Where the heads of the canyons come in close to the coast the deep water has made a favorable situation for the building of piers. Filling at these piers has proved less troublesome than at the ends of most other piers off the California coast.

However, this location may be fraught with difficulties, since the canyon represents a funnel down which the bottom deposits may slide or be swept by storm waves.

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