the formation of the foundations of coral reefs honestly, we are forced to admit that all our theories and considerations are mere camouflage for our lack of knowledge" (p. 160).

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TREE TWIST

ON reading the query on tree twist in SCIENCE, the idea struck me that I was particularly well situated to observe this phenomenon. This is due to the fact that in north China (1) burial grounds are planted with trees symmetrically arranged, resembling an orchard, (2) these burial grounds stand out in the plain as islands at sea with no shelter for rods to miles about them (3) that most of them are planted with one species of tree: the oriental white cedar or Arbor Vitae (*Thuya orientalis*). The advantages thus secured are that of isolation, so that only meteorological and edaphic forces would affect the trees. There is no slope, the substratum being an alkaline plain. The trees are equally spaced so that if the wind is a factor in causing twist, the corner trees should be most twisted and the central ones least, while the others would be progressively less twisted. The soil in these small plots (the largest observed was about 20 by 37 yards) would be the same, being loess with a depth of ten to twenty or more feet. In places this loess is interrupted by beds of conglomerate which would then affect the entire ground as a unit. The species of tree is so "thin skinned" and the bark so striped as to make twist in the wood, and in the "insertion" of the branches, easily observable. The climate is semiarid with heavy summer rainfall and very little rain the rest of the year. Throughout the spring there are high winds blowing from the south and southwest for one to three days' duration. These winds are so strong and dry and hot as to cause all trees of the region to develop to the northward. The Arbor Vitaes thus have the boles bent often very strongly to the north. This bending is most accentuated in the taller trees and at their tops.

Unfortunately such a plantation does not usually develop uniformly. The trees which die out are later replaced. Moreover at times of financial stress, a tree here and there will be taken down and some time after replaced by young trees. However, these factors can be taken into consideration and due allowance made, or observations in such groves can be checked by observations in groves that have had no such interference.

The present notes are based on charts plotted for four such burial grounds lying three quarters of a mile south of the Shantung Christian University campus (Tsinan, Sung.) near the village of Djang Djia, as well as on several isolated trees and a double row of fourteen trees.

The twist in *Thuya orientalis* of this region is to the left. In *T. occidentalis* reported in SCIENCE for May 22 it is to the right. Of 438 trees observed: 272 had the boles twisted to the left, 157 were not twisted, six had only the lowest two feet twisted, one was twisted in different directions every three or four feet and two were twisted to the right. There was no correlation whatever with exposure. Similarly there was no correlation with the lean or inclination of the tree. Some had a slight twist at the lowest two feet but were straight the rest of the way. Large old trees were usually free from twist! Is twist then a hang-over of seedling development, which carries over more strongly in some individuals than in others? Certainly it is not related to wind or other obvious environmental factors.

In one of the groves the two south rows and two north rows consisted of *Juniperus chinensis*. Of the 38 trees standing, 20 had the boles twisted to the left, 16 were straight and two were twisted to the right. There was correlation with neither exposure nor sex.

The charts of these groves are to be deposited with Professor Nichols at the Osborn Botanical Laboratories of Yale University.

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MARINE TERTIARY IN ARIZONA[1]

IN April, 1931, while studying the geology and mineral deposits of southern Yuma County, Arizona, the writer found a fossiliferous Tertiary formation that hitherto had not been recognized. This formation outcrops from beneath later silts, sands and gravels, as several areas in the broad, terraced, dissected plains that border the Colorado River north of latitude 33° 10′. It consists of well-stratified, weakly consolidated conglomerates, sandstones and marls, alternating with chalky and dense limestones to make up a total maximum apparent thickness of approximately 1,000 feet. Fossils from its calcareous members were submitted, through Dr. John C. Merriam, of the Carnegie Institution of Washington, to Dr. W. P. Woodring, of the U. S. Geological Survey. Dr. Woodring[2] identified the following forms: Cerithid, *Pisidium* (?), *Corbicula* (?), barnacle, ostracode, calcareous algae, and *Chara* (?) encrusted with algae (?). These forms, he states,[2] show that brackish waters once reached the region, but do not determine the age. He further states:[2] "Perhaps this marine invasion is the same as the one recorded in the southwestern part of the Colorado Desert, (California) which I regard as Miocene, but which most

[1] Published with permission of the director of the Arizona Bureau of Mines, University of Arizona.

[2] Written communication.

California geologists consider Pliocene (See Carnegie Inst. Washington Pub. 418, pp. 1–25. 1931)."

Heretofore, no Tertiary of definitely marine origin has been known to occur in Arizona, and none nearer than the Salton Sea-Carrizo Creek region, some sixty miles west of the Colorado River. John Brown,[3] C. P. Ross,[4] and others have suggested the possibility that, in late Tertiary time, the Gulf of California may have extended far up the drainage of the Colorado River. East of Parker, R. C. Blanchard[5] collected *Bittium* and a probable young *Corbicula*. In the same area, C. P. Ross[6] found what appeared to be a minute *Corbicula*. West of the Colorado River, opposite Cibola, Brown[6] gathered the same material as Ross. Although *Bittium* and *Corbicula* are prone to inhabit brackish waters, Ross[7] did not regard the presence of the one *Bittium* and the probable *Corbicula* as conclusive evidence of the character of the waters in which these beds were deposited. The barnacles found by the writer, however, are unquestionably marine.

Very little faulting, no folding, and only minor tilting are apparent in this formation. Near Parker, it overlies an extensive, tilted series of red beds and underlies basalt. East and southeast of Cibola, it abuts against and overlies unconformably the roughly eroded slopes of granite, schist, and lavas of present-day mountains. Because of such barriers, its eastward extension in Arizona may not have been great, and no traces of it were found along the river south of, approximately, latitude 33° 10′, where its limiting mountains converge to the river's channel. West of the Cibola region, however, no continuous mountain barriers are apparent for a great distance. John Brown's map[8] of the Salton Sea region shows many wide passes between the mountain ranges of that part of the region between the Salton Sea and Colorado River. Consequently, this sea-way probably had its outlet westward towards the present Salton-Carrizo region, and thence southeastward to the Gulf of California, rather than directly along the present Colorado River channel.

The writer plans to carry out further study of this formation, in as much as it offers to shed much needed light upon the Tertiary history of western Arizona.

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3 U. S. Geol. Survey Water-Supply Paper 497, p. 46, 1923.
4 U. S. Geol. Survey Prof. Paper 129, pp. 195–196, 1922.
5 Columbia Univ. Contr. Geol. Dept., vol. 26, No. 1, p. 39, 1913.
6 See U. S. Geol. Survey Prof. Paper 129, pp. 189–190, 1922.
7 U. S. Geol. Survey Prof. Paper 129, p. 195, 1922.
8 U. S. Geol. Survey Water-Supply Paper 497, Pl. 12, 1923.

THE SO-CALLED AUTOXIDATION OF CYSTEINE

In a recent paper Gerwe[1] presents figures to show that the oxidation of neutralized cysteine hydrochloride is much too rapid to be accounted for by the extremely minute amounts of iron which may be present in a pure preparation, and concludes, therefore, that pure cysteine is autoxidizable. It is very surprising that he should make this conclusion without considering the possible effect of copper in the oxidation of cysteine. Gerwe[2] states in a previous paper concerning the preparation of iron-free cysteine hydrochloride by crystallization from HCl that small traces of copper which may have been present in the crude preparation were completely removed long before the iron in the early crystallizations. He gives no data to substantiate this statement.

I wish to call attention to several facts in a paper[3] which I published about a year ago on the catalytic action of copper in the oxidation of cysteine which bear on this question. The method which I used for the preparation of cysteine at that time is very similar to the one which Gerwe describes in his recent paper. The oxygen consumption of my sample was 1.2 cmm per hour for 8 mg cysteine hydrochloride, while Gerwe reports his to consume 2.2 cmm per hour for 10 mg cysteine. My sample was, therefore, equally as pure as his preparation. When pyrophosphate, which increases the activity of copper, was added to my sample of cysteine, there was a considerable increase in the oxygen uptake. This shows that the impurity which caused the residual oxidation was undoubtedly copper. If the metal had been iron, the oxidation would have been retarded rather than increased.

Gerwe found the oxygen consumption of 10 mg of cysteine to increase 5.22 cmm per 0.0001 mg Fe. I found the oxygen uptake for 8 mg of cysteine to increase 86.0 cmm for every 0.0001 mg Cu. Therefore copper is at least 16 times as active as iron. Gerwe concludes that the amount of iron necessary to account for the oxidation of his pure cysteine would be 44 times as much as could possibly be present. Since copper is so much more active than iron, the presence of this element in slightly larger amount than that calculated for iron would explain the observed oxidation of the cysteine.

A catalyst does not initiate a chemical reaction but merely alters the speed of the reaction. Naturally then even absolutely pure cysteine must undergo some oxidation or else the rate of oxidation could not be increased by the addition of catalysts. An oxygen uptake of about 2 cmm of O_2 per hour for 10 mg of cysteine is a very slow rate of oxidation (the 10 mg

1 E. G. Gerwe, *J. Biol. Chem.*, 92: 399, 1931.
2 E. G. Gerwe, *J. Biol. Chem.*, 91: 57, 1931.
3 C. A. Elvehjem, *Biochem. J.*, 24: 415, 1930.