for the now submerged canyons along the continental coasts.

Professor Shepard makes the point that the parallel of 35° is a nodal line, at which there would be no change of sea level but about which sea level would oscillate, rising (for increased velocity of rotation) below 35° and falling for higher latitudes. Therefore, says Professor Shepard, the hypothesis is inadequate to explain submerged valleys north of 35°. Professor Hess in SCIENCE for June 18 replies in effect that the distribution of land and water is such that the nodal parallel of latitude might be 55° or 60°.

The problem of change of level due to changing ellipticity of the earth and ultimately to a change in its rate of rotation has a strong analogy to the problem of the tides. The deformation of the level surfaces is of the same type and a change in sea level due to a change of ellipticity is essentially a change of level due to a quasi-permanent long-period tide.

The problem of the effect of the distribution of land and water on the tide, in so far as the level surfaces of the water coincide with the level surfaces of the field of force, was treated in Kelvin and Tait's "Treatise on Natural Philosophy" but is set forth more clearly and at greater length in an article by G. H. Darwin and H. H. Turner in the *Proceedings of the Royal Society* of London (Vol. 40, pp. 303–315, 1886). This article is reproduced in Darwin's "Scientific Papers," Vol. I (Cambridge, England, 1907) pp. 328–339.

The nodal line for long-period tides is in latitude 35° 16′ for an earth completely covered with water. The correction for the presence of land changes this figure very little. Darwin and Turner, in evaluating it, schematize the actual coast line a little and thus obtain figures varying between 33° 29′ and 35° 04′. Professor Shepard's point seems therefore well taken; the nodal line remains near 35° north or south latitude.

This calculation ignores the self-attraction of the water. This may readily be allowed for in the case of an earth covered with water; it increases the tidal or rotational effects about 12 per cent. In the case of the actual earth theoretical solutions have been sketched, but no one has undertaken the enormous labor of a numerical evaluation. Presumably it affects the essential result but slightly.

These calculations assume steep walls at the coast line, with no laying bare of shoals or flooding of lowlands. It is to be presumed that effects of this sort have little effect on the final conclusion, especially in view of the fact that it is difficult to accept a change in the earth's rotation sufficient to cause any great change in the depth of the ocean within Recent, Pleistocene or even remoter time, a change sufficient to account for known submarine canyons.

The change in the difference between equatorial and polar radii due to a change of 1 per cent. in the rate of rotation is

$$\frac{1}{100} \times \frac{1}{289} \times 6370 = 0.22 \text{ kilometers}$$

The factor $\frac{1}{100}$ is the assumed 1 per cent. and may be replaced at pleasure by $\frac{2}{100}$ or by any other small fraction. The factor $\frac{1}{289}$ depends on the rate of rotation, the acceleration of gravity and the size of the earth, which latter appears again as 6,370 km, the mean radius.

This simple calculation assumes a rigid earth covered by water. The change in the difference between equatorial and polar radii then means difference in the depth of the ocean. It allows only for the direct effect of rotation and neglects the yielding of the earth and the self-attraction of matter. There is no absolutely unyielding substance, and matter is self-attracting. The proper factor to allow for these in the case of elastic yielding is imperfectly known, but, from observations of earth tides, appears to be between 0.70 and 0.85. The result of applying this factor is the relative observable change in level between land and water.

If the yielding were plastic instead of elastic, the factor would be about 2 for the ellipticity. But if we consider plastic yielding, we must remember that what we observe is, not the ellipticity, but the displacement of the solid, though plastic, earth relative to the sea and that this is a small second-order effect depending on the depth of the ocean. This means that the computed 0.22 km must be multiplied by a factor between 0.85 and almost zero. A change even of 1 per cent. in the rate of rotation since Pleistocene time seems improbable and an even greater change would not help much in accounting for known submerged canyons.

WALTER D. LAMBERT
U. S. COAST AND GEODETIC SURVEY

THE ANTISCORBUTIC PROPERTIES OF A SALT OF IRON AND ASCORBIC ACID

THE successful use of ferrous-ascorbic acid compounds[1,2,3] in the treatment of secondary anemias has already been recognized to some extent. This present communication concerns itself with an investigation of a salt of reduced iron and the levo-rotatory form of

[1] A. Szent-Györgyi, *Hoppe-Seyler's Zeit. f. Physiol. Chemie*, 225: 168, 1934.
[2] K. Maurer and B. Schiedt, *Biochem. Zeit.*, 285: 67, 1936.
[3] D. G. Friend, *Jour. Am. Med. Asn.* (in press), 1937.

ascorbic acid which has proved itself non-toxic when administered intravenously to either experimental or human subjects and has been used in this clinic for the treatment of secondary anemias.[3] This salt was found by us to have a highly antiscorbutic property when given intravenously, daily, over a period of six days to a patient with severe scurvy. A daily dose of 250 mgm was sufficient to bring the plasma ascorbic acid level from .02 mgm per cent. to 1.2 mgm per cent. and the withdrawal of marked scorbutic symptoms.

With the cooperation of Dr. Alexander and Dr. Townsend, these findings were confirmed in scorbutic guinea pigs and in normal subjects. An interesting feature in the use of the salt, as is especially demonstrated in normal subjects, is the slow rise in the plasma ascorbic acid content as determined by the method of Pijoan and Klemperer,[4] following its intravenous injection as contrasted to the slope of the values obtained after the injection of ascorbic acid. It would appear from these biological tests that the compound of iron ascorbate breaks down slowly. Chemically, after precipitating the ferrous iron by H_2S as ferrous sulfide and the reduction of the ascorbic acid by H_2S, we were able by the method of Emmerie[5] to recover 97 per cent. of the ascorbic acid. This would indicate that in the salt the double bond of the ascorbic acid molecule is still present, which alone would allow for further reduction to ascorbic and titration with 2.6 dichlorophenol indophenol. The salt as synthesized by us and by Messrs. Hoffman-LaRoche contains 20 per cent. iron and in a 1 M. solution is of pH 6.9. At this pH only one of the hydrogens at the double bond could be replaced by iron. In conclusion, this salt is not only successful in bringing ferrous iron into the treatment of secondary anemias but has valuable antiscorbutic properties in which single daily doses produce prolonged and increased plasma ascorbic acid values.

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THE SURGICAL CLINIC OF THE
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THE MAYNARD PLUM—A CARRIER OF THE PEACH MOSAIC VIRUS

SINCE 1935 plum trees have been suspected of being carriers of the peach mosaic disease in the Palisade district, Colorado, though they show no apparent symptoms of the disease. To investigate this possibility, fresh roots and twigs were taken from six Maynard plum trees growing in an area where heavy losses had been incurred from peach mosaic.

On September 4, 1936, buds from each of these plums were grafted into five one-year-old peach seedling trees, making a total of 30 budded seedling trees. With the beginning of growth in the early spring of 1937, 15 seedling peach trees grafted with buds from parent plum trees Nos. 1, 5 and 6 showed typical symptoms of peach mosaic. The remaining 15 trees grafted with plum buds from parent plum trees Nos. 2, 3 and 4 remained healthy. All buds made growth unions. Twenty-eight seedling peach trees used as control remained healthy. The experiment was conducted in an isolated planting in a remote valley many miles from the mosaic-infected region.

On March 23, 1937, roots collected from the six Maynard plum trees were grafted on roots of 34 two-year-old peach seedling trees. Peach mosaic symptoms were observed on May 15 of the same year on 15 of the 17 peach seedling trees, which were root grafted, using plum trees Nos. 1, 5 and 6 as stock. Two root grafts failed to make growth unions and the peach trees remained normal. Seventeen peach seedling trees root grafted with roots from plum trees Nos. 2, 3 and 4 remained normal also. Thirty-three peach seedling trees used as controls remained free of infection.

From these experiments it appears that plums may be carriers of the peach mosaic virus, though the trees do not show the symptoms evident in the peach.

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A COMPANION WORD FOR PLANKTON

IN SCIENCE for September 25, 1936, I asked for a new word to rank with plankton, but indicating food that is found in the top layer of mud, feeding perhaps as many forms of life as the ones depending upon plankton.

The numerous answers made too extensive text for publication as a group in the limited space that could be devoted to them, but I have selected the gist of the material for brief presentation. Incidentally, in my original letter I should perhaps have added *Accipenser* and larval *Petromyzon* to the group using this food.

Dr. Wm. Rienhoff, Sr., of Baltimore, Md., suggested either Iloen or Ascion, expressing in slime-imbedded organic particles serving as animal foodstuffs in contrast to plankton, expressing free floating material.

Dr. W. A. Dayton, of the U. S. Forest Service, suggested "ilyophagous organisms." He said the Greeks had a word for mud feeder, "borborophagous."

Dr. Carl L. Hubbs, curator of fishes, University of Michigan, suggests "hyperbius."

Dr. Dorothy Cobb Adams, of the Johns Hopkins Hospital, suggested "limous plankton" from *limus*—mud or slime.

[4] M. Pijoan and F. Klemperer, *Jour. Clin. Invest.*, 16: 3, 443, May, 1937.

[5] A. Emmerie, *Biochem. Jour.*, 28: 268, 1934.