The term *chute,* while new in this connection, is needed. It may be defined as a "minor plunging syncline on the flank of a much larger anticline or syncline or in a monocline." It causes the isobaths to make a wave in the up-dip direction.

Saddles

A saddle is a down fold in the axis of an anticline, or an up fold in the axis of a syncline. This form partakes of the nature of both an anticline and a syncline, as is evident if a model in sheet lead is turned upside down—when we find it is still a saddle, but at right angles to the original one.

For surfaces involved in recumbent, erect, carinate, isoclinal or fan folds, the present fold terms may be used without modification.

The greatly increased use of the geologic surface in economic geology has led to the proposal of this specific set of terms, for which the current nomenclature of folds was not adequate.

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THE ORIGIN OF THE "NITER SPOTS" IN CERTAIN WESTERN SOILS

In an article entitled "The Origin of the 'Niter Spots' in Certain Western Soils," which appeared in the *Journal* of the American Society of Agronomy, Vol. 6, No. 6, Professors Stewart and Peterson of the Utah Experiment Station state on pages 246, 247 and 248 of the publication cited, that,

The brown color of the "niter spots" is produced by the solvent and decomposing action of the sodium nitrate upon the organic matter of the soil in just the same way that the black color of the black alkali spots is produced by the solvent and decomposing action of the sodium carbonate upon the soil organic matter. . . .

The color (of the black alkali) is produced by the sodium carbonate, because, being the salt of a weak acid and a strong base, it readily hydrolyzes, producing sodium hydroxide, or caustic soda, which, as is well known, acts on carbohydrates, producing a brown color, the intensity of which depends on the concentration of the sodium or potassium hydroxide, thus readily accounting for the production of the color of black alkali. *Likewise, in the case of sodium or potassium nitrate, the salt being the result of this union of a strong base and a stronger acid than carbonic acid, does not hydrolyze so easily and as a result there is a smaller amount of sodium or potassium hydroxide present and necessarily the production of a milder color as observed in the brown alkali (niter) spots. The sodium and potassium sulphate and chloride, being the salts of strong acids and bases, do not hydrolyze, therefore caustic alkali is not produced, and consequently the color is not produced by these alkali salts.*

It will be seen that while the authors state that the alkali sulphates and chlorides are not hydrolyzed at all, being the salts of strong acids and strong bases, they assert that the nitrates are hydrolyzed, though to a less extent than the carbonates, being the salts of a stronger acid than carbonic. The natural inference is that the authors regard nitric acid as being a weaker acid than either hydrochloric or sulphuric.

It has long been recognized that the strength of acids depends upon their degree of ionization. In the third English edition of Treadwell's "Analytical Chemistry," Vol I., p. 16, we find that in $N/10$ solution, nitric and hydrochloric acids are both ionized in the extent of approximately 90 per cent., while in the third English edition of Ostwald's "Principles of Inorganic Chemistry," p. 248, we find the extent of the ionization of hydrochloric acid in $N/10$ solution to be 95 per cent., while that of sulphuric acid is only 57 per cent. It is thus evident that the view, commonly accepted by chemists, that hydrochloric and nitric acids are of approximately equal strength, and that sulphuric acid is considerably less strong, is correct. Since the only salts of the alkalis which are hydrolyzed are their salts with weak acids, it is clear that the sulphates, being salts of a weaker acid than nitric, should be hydrolyzed to a greater extent than the nitrates.

On page 247, Table 8, of their article, Stewart and Peterson show that while a 1-per cent. solution of sodium nitrate dissolved 0.8 per cent. of the organic matter of a given soil, a 1-per-cent. solution of sodium sulphate extracted 1.19 per cent. of it, that is to say, 48.75

per cent. more than the nitrate. We have shown that sodium sulphate should be hydrolyzed to a greater extent than sodium nitrate; consequently, it should have not only a greater solvent action than the nitrate, but also a greater decomposing action on the organic matter, resulting in the production of a darker brown color. In view of the very general and abundant distribution of alkali sulphates in western soils, and granting the presence of sufficient organic matter for the production of a brown color according to the hypothesis of Stewart and Peterson, we should expect to find a uniform distribution of a dark brown surface color throughout the soils of the arid west. This is not the case.

As a matter of fact, neither the nitrates nor the sulphates are hydrolyzed at all. Stewart and Peterson admit that the sulphates are not hydrolyzed, but claim that the nitrates are. It is indeed difficult to reconcile their claim with the facts in the case. Since the alkali nitrates are not hydrolyzed, and since alkali hydroxides could be produced from them in no other way than by their hydrolysis, it is very evident that no alkali hydroxides are formed, and consequently the explanation of the brown color of the "niter spots" as given by Stewart and Peterson is nothing short of preposterous.

The question raised by the above writers concerning the relation of the pigment of *Azotobacter chroococcum* and the nitrate to the brown color of the "niter spots" applies only to the colorless strains of the organism. These have been shown by us to be capable of producing abundant brown to black pigment when supplied with very small quantities of nitrate (0.01 to 0.03 per cent. sodium nitrate) and some source of energy, both of which are present in our niter soils. Aside from these colorless strains, their contention is wholly irrelevant for we have already pointed out[1] that four of the seven strains of *A. chroococcum,* isolated from niter soils have produced, at one time or another, pigments varying in color from a delicate cream, through the different shades of brown, to an intensive brownish black in the *total absence of nitrates,* thereby

[1] Colorado Experiment Station Bulletin, 179, p. 33, June, 1911.

attesting their ability to produce the pigment independent of the nitrate.

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CALCULATION OF THE GAMMA FUNCTION

TO THE EDITOR OF SCIENCE: In SCIENCE, April 2, 1915, Dr. Raymond Pearl has described a method of obtaining an approximate value of log $\Gamma(n)$ by interpolating in a table of log-factorial n.

In a table he compares the values obtained by interpolation, by Forsyth's method of approximation, and those found by using the relation

$$\Gamma(n+1) = n(n-1)(n-2) \cdots$$
$$(n-r)\Gamma(n-r)$$

in conjunction with Legendre's tables, calling the value obtained by the last method the "exact" value.

Dr. Pearl explains that this "exact" value derived its name from the exactness of the mathematical argument upon which it is based, and not from any special accuracy in the numerical values given under that heading and he disclaims any greater degree of accuracy than can be expected from the summation of a large number of seven-place logarithms.

As the subject to be investigated is not how closely the values obtained by different methods agree with one another but how closely the approximate to the true value of the function, I have calculated a "more exact" value for the cases given by Dr. Pearl, using Legendre's table and ten-place logarithms and I believe the values so obtained are correct within a half-unit of the seventh decimal place.

Another set of values has also been calculated by means of Pearson's approximation formula[1]

[1] "On a Formula for Determining $\Gamma(x+1)$," *Biometrika,* Vol. VI., p. 118.

$$\log \frac{\Gamma(x+1)}{x^x e^{-x}} = .3990899 + \tfrac{1}{2}\log x$$
$$+ .080929 \sin \frac{25°.623}{x}$$

or