gold, silver and quicksilver resources of the United States and the mineral and geological characteristics of the Philippine Islands. Consisting of nearly 3,000 volumes and pamphlets, the library includes many out-of-print bulletins of the U. S. Geological Survey as well as the transactions of the American Institute of Mining Engineers since the beginning of the organization in 1871.

SUCCESSFUL use of radio communication service in fighting recent forest fires at Isle Royale, Mich., Great Smoky Mountains National Park and Glacier National Park is reported by the National Park Service. John D. Coffman, chief forester, advocates experiments in the use of high and ultra-high frequency radios and its adaptation to National Park Service needs. He states that in Isle Royale the National Park Service was completely dependent upon radio for communication. This was the case both between the island and the mainland, and between various base and side camps on the island where 1,600 men from the CCC camps were billeted for a month. Without radio there would have been no communication service. On September 1 there were eleven radio sets in operation on Isle Royale. Also in the fire suppression work carried on in Great Smoky Mountains National Park and in Glacier National Park, Mont., the radio played an important part.

DISCUSSION

A DOZEN MATHEMATICAL ERRORS IN WEBSTER'S DICTIONARY

TWENTY-FIVE years elapsed between the publication of Webster's "New International Dictionary" and the extensively revised second edition (1934), and it may be assumed that this second edition will be used in practically its present form for many years. It may therefore be of interest to mathematical students to note here a sufficient variety of definite errors which appear therein and relate to their subject to inspire the desirable caution which is too often lacking in the use of standard works of reference, especially on the part of the younger students. The suggested corrections may enable some to improve their own copies of this standard book by adding appropriate notes. A few other modifications relating to this dictionary were suggested by the present writer in SCIENCE, 81: 513, 1935.

Under the term "spherical excess" it is stated that "its product by twice the square of the radius of the sphere on which the triangle is drawn is equal to the area of the triangle." As the correct rule for finding the area of a spherical triangle appears in many of our school text-books it is easy to verify that the word "twice" should not appear in this quotation. Under the term "primitive group" there appears the following definition: "A transitive group of substitutions on n letters such that all the substitutions of the group which omit a given letter form a group involving all the other letters." This condition is obviously not satisfied by the regular primitive groups of prime degrees and there are also transitive groups which satisfy this condition but are not primitive. As an example of the latter we cite the group of degree 6 and of order 72. The given condition is therefore neither necessary nor sufficient.

Under the term "dicyclic group" appears the following supposed definition: "A group generated by two elements a and b, in such a manner that every element is of the form a^x or ba^x, the element a satisfying the equation $a^{2m} = 1$, and the element b having its square $= a^m$, where m is an integer." While every dicyclic group satisfies this definition there are many other groups which also satisfy it. A necessary and sufficient condition that a group satisfies it is that it involves a cyclic subgroup of index 2 and at least one element of order 4 which does not appear therein. In particular every abelian group whose independent generators are of orders 2 and $2m$, where m is even, satisfies the given definition, but none of these groups is dicyclic according to the usual definition of this term. Under the term "dihedral group" there appears an illustrative example which implies that the dihedral group of order 8 is known as the axial group instead of the octic group.

Under the term "binomial theorem" there appears the following sentence: "The theorem propounded by Sir Isaac Newton by means of which a binomial may be raised to any power without performing the multiplication." The implication is that it is confined to positive integral values of the exponent, since otherwise the process of performing the multiplication would be impossible. For such exponents it was known to the Arabs in the twelfth century and to the Chinese in the fourteenth century. In the form given in this dictionary and in many of our modern text-books it was known by H. Briggs (1556–1636), who died before Newton was born. Under the term "hexagram" it is called the "Pythagorean symbol." This symbol was the pentagram according to the "Manual of Greek Mathematics" by T. L. Heath, page 108, 1931.

Under the term "metacyclic" there appears the following sentence: "Denoting or pertaining to any permutation of elements in any given cycle of numbers."

If such a cycle would involve n numbers each of the possible $n!$ permutations of these numbers would be metacyclic according to the given definition. I know of no authority for the use of the common mathematical term "metacyclic" with this meaning and see no reason for using it thus. Under the term "Transitive group" it is stated that "if any set of n elements is replaced by any such set, it is *n-ply* transitive." If this were true it would follow that when a group of degree n is simply transitive it is also n-1 times transitive, which is obviously not necessarily true. In order that a group is *n-ply* transitive it is not sufficient that every set of n letters found therein is replaced by its substitutions by every other such set, but this replacement must occur also in every possible order. The fact that this distinction is frequently omitted elsewhere makes it the more desirable that it should be clearly given in a standard reference work.

Under the term "permutable" there appears the following sentence: "Leaving a finite group unchanged when it is operated upon by the group and the result is operated upon by the inverse of the original operation." It is difficult to see what is meant by operating on a group by the group. The term "permutable" is used in group theory with a wider meaning when it relates to groups than when it relates to operators. At any rate, the quoted sentence is practically meaningless but relates to an important mathematical property. Under the term "group of an equation" there appears the following statement: "A transitive substitution group, of the same degree as the irreducible equation, that does not change any function of the roots that is expressible rationally through the coefficients, but changes every other." The group of a reducible equation is intransitive and the definition of the term "group of an equation" should include this case. The definition of the preceding term, "group of a function," is also incomplete, since it applies also to every subgroup of this group.

In the biographical section which appears at the end of this dictionary the Hindu mathematician Aryabhata is said to be "the earliest known algebraist" and to have flourished in the fifth century, while Diophantus of Alexandria is called a "Greek algebraist" who flourished in the third century. It is obvious that it is impossible that both of these statements are correct. The well-known Norwegian mathematician Sophus Lie is here said to have died in 1870, when he was only twenty-eight years old. As a matter of fact most of his extensive works were published after this date, and he died in 1899 at the age of fifty-six years. One looks in vain in this section for the name of one of the most noted French mathematicians, E. Galois (1811–1832), whose fame has gradually increased since the time of his early death and has far outstripped that of many others whose names appear here.

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THE CHLORINE CONTENT OF THE LEDA CLAY

A SAMPLE of fossiliferous Leda clay (Pleistocene) collected in a road cut near Waterville, Maine, was recently analyzed by one of our students, U. U. Savolainen, of the Tufts College Chemical Department, for its chlorine content. The results, although provisional, indicate that further work along similar lines may prove of interest and of geologic value.

The sample analyzed was a light grey unweathered clay containing abundant, well-preserved shells of *Mytilus edulis*. Microscopic examination showed it to be made up largely of colloidal clay particles, although there was some rock flour associated with the finer material.

The specific gravity of the fresh clay, determined by the paraffin dip method, was found to be 1.88, while that of the dried clay was 1.47. From these figures the pore space was calculated to be about 41 per cent.

The chlorine content was found by leaching the finely divided clay with distilled water and titrating with silver nitrate solution, using potassium chromate as the indicator. The results obtained varied from .0000731 to .0000789 grams of chlorine per gram of clay. From this and the pore space the possible amount of chlorine in the water that was assumed to have originally occupied the pore space was determined. This was found to be between .174 and .194 grams of chlorine per 1,000 grams of water.

At the present time the average amount of chlorine in sea water is about 19 grams of chlorine in 1,000 grams of water. Since the ratio of the chlorine to the total amount of salts in sea water is nearly constant, the chlorine found in the clay seems to indicate that the original sea water enclosed by the clay was about 1/100th of the average salinity of the present-day oceans. This low figure may be explained in several ways.

First of all, there is the ever-present possibility of error in the determination of such minute amounts of chlorine.

Secondly, there may have been some leaching of the chlorine content after the deposition of the clay. But this seems quite unlikely as indicated by the well-preserved shells of Mytilus.

Thirdly, there arises the possibility of chemical union or physical affinity of the chlorine with the clay constituents. How far this can take place, it is impossible to say.