bon monoxide and chlorine are evolved. The production of carbon monoxide by an electrolytic method is unique, as it has heretofore not been obtained by electrolysis.

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WHAT IS AN ACID?

IN terms of the theory of electrolytic dissociation, an acid is any substance which yields the hydrogen ion in water solution, and a base any substance capable of yielding the hydroxide ion under similar circumstances. But Franklin has shown that this definition of a base is too narrow, and that a comprehensive definition should include substances capable of yielding the amide ion in ammonia solution. The question may, then, be legitimately asked, if bases may include substances that do not yield the hydroxide ion, may there not exist acids that do not yield the hydrogen ion?

I have recently been forced to the conclusion that the answer to this question is in the affirmative. The evidence, which I shall discuss more fully in another paper, consists in the following facts. Aluminium chloride is very soluble in liquid phosgene, $COCl_2$, and several phosgenates of aluminium chloride have been described in the literature. I have shown that this solution conducts electricity and that the products of electrolysis are carbon monoxide and chlorine. I have also shown that this solution reacts with metals, with metallic chlorides, oxides, sulfides and carbonates to form compounds, containing the metal as chloride, and aluminium chloride, with phosgene of crystallization, and that carbon monoxide, carbon dioxide, carbon oxysulfide are split off.

These observations become intelligible if we assume that the active substance in the solution is a phosgenate of aluminium chloride, such as $2AlCl_3.COCl_2$, which may be compared with the behavior of $2SO_3.H_2O$, or with $SO_3.H_2O$ in water solution; it is customary to write $H_2S_2O_7$ or H_2SO_4 to represent the condition of the hydrates of sulfur trioxide, and in an analogous manner we are led to write $COAl_2Cl_8$ to represent the condition of the phosgenate of aluminium chloride in phosgene solution. This compound, carbonyl di-chloraluminate, reacts with metals to produce salts of the type $M^{II}Al_2Cl_8.xCOCl_2$ (using a bivalent metal as example), with liberation of carbon monoxide, in precisely the same manner as sulfuric acid produces, with metals, salts of the type $M^{II}SO_4.xH_2O$, with liberation of hydrogen. With metallic chlorides, carbonyl di-chloraluminate reacts to produce salts of the same type, splitting off phosgene, in precisely the same manner as sulfuric acid produces sulfates with the metallic oxides, splitting off water. The analogy may be carried on to the other reactions and to the electrolysis of the two solutions, and the conclusion becomes inevitable that these solutions have properties so precisely similar that we must classify them in the same group—in other words, carbonyl di-chloraluminate is an acid. But this acid contains no hydrogen; in its place, we have carbon monoxide. The metallic chlorides must be regarded as bases, and the chloride ion in these bases corresponds to the hydroxide ion among the aquo-bases, and to the amide ion among the ammono-bases.

What, then, is an acid?

First of all, an acid involves a solvent, and as far as we know an ionizing solvent—such as water, ammonia, phosgene, to mention only those we have referred to in this note. In the second place, an acid is a substance dissolved in the solvent, which is chemically combined with a portion of the solvent, as SO_3 is combined with water, as $AlCl_3$ is combined with phosgene, or as C_3N_4 is combined with ammonia (cyanamide, H_2CN_2, or di-cyanimide, $HN(CN)_2$). Finally, solutions of these acids in their respective solvents give certain definite reactions—they conduct electricity and the solvent is decomposed in the process; metals displace the ion common to the acid and the related solvent (H, CO, etc.) forming salts; they react with bases derived from the related solvent to form salts, splitting off a molecule of the solvent; etc.

In short, an acid is the substance formed when an ionizing solvent unites chemically with a suitable compound and is capable of forming salts with metals and with bases derived from the same solvent.

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MIOCENE MARINE VERTEBRATES IN KERN COUNTY, CALIFORNIA

PROBABLY the first vertebrate fossils collected in California were the teeth of sharks picked up by W. P. Blake, geologist of the Williamson contingent of the Pacific Railroad Survey, in 1853.

The original location was given as "Depot Camp" on the south side of Poso Creek (called Posé Creek in the original reports; also called Ocoya Creek and spelled Ocoga on the map) "Lat. 305° 30′ 27″, Long. 118° 53′ 02″," Kern County, California. The specimens were described and illustrated by L. Agassiz.[1]

[1] *Am. Journ. Sci. Arts,* 1856, pp. 272–275; Pac. R. R. Reports, Vol. 5, 1857, pp. 313–316, plate 1, figs. 1–44; for a full account of the occurrence of the specimens see pp. 164–173.

The deposit from which these specimens came has been traced more or less continuously for twenty miles along the eastern side of the Great Valley from Bena on the south, across Kern River and to the so-called "Fullers-Earth" mine on Granite Canyon about four miles north of Poso Creek. The outcrop can not always be found along the strike the entire distance, but in many places erosion and stream-cutting have exposed it.

A few places have long been known for the abundance of shark's teeth exposed on the surface. Most important of these is that known locally as "Shark Tooth Mountain" on Section 25, T. 28 South, R. 28 East, M.D.M., four miles east of the Kern River Oil Field and one half mile north of the river.

Here for fifteen years Mr. Charles Morrice, of the Pacific Oil Compnay, has worked in excavation, and a very great number of teeth have been taken out. Dr. David Starr Jordan has used many of these specimens in his monographs of the extinct sharks of the west coast.[2]

Through his studies on the fossil Pennipedia and Cetacea Dr. Remmington Kellogg was attracted to the locality and in a recent paper[3] he has described at length certain seal and sea lion bones which Mr. Morrice had previously presented to the California Academy of Sciences.

The deposit on Shark Tooth Mountain appeared to Dr. Kellogg to be so important as regards marine mammalia that he suggested to Mr. Morrice to save a collection of bones during his excavation. This was done at odd times when other regular duties permitted, but in the course of a few months representative bones of many marine groups were uncovered. Probably the most important were two skulls of sperm whales, but there were parts of skeletons of turtles, birds, dolphins and other cetaceans, seals and sea lions. A technical report upon this collection is in course of preparation by Dr. Kellogg under the auspices of the Carnegie Institution of Washington.

The location of the Shark Tooth Mountain deposit is on property belonging to the Pacific Oil Company of San Francisco, and the officials of this organization have taken notice of the scientific value of so great an accumulation of fossil vertebrates. Through their interest in the subject Mr. Paul Shoup and Mr. M. E. Lombardi have taken steps to have as large and representative a collection as possible obtained. It is their desire that the main portion of this collection shall remain preserved in a western museum where it will be readily available for consultation by local students. The California Academy of Sciences seemed to offer suitable facilities for storage and display of the specimens, and through an arrangement with Dr. Barton W. Evermann, director of that institution, cooperation in the working of the deposit has been effected.

In the field, assistance has been provided for Mr. Morrice in the excavation work, and in the course of a little over one month about three hundred bones have been taken out. These are of many groups of vertebrates, sirenians and perhaps walruses being represented in addition to those mentioned above.

There are several remarkable features connected with this deposit, most of which must await future exploration for explanation.

The bones occupy a stratum not over three feet thick so the extinction of the excessively abundant species must have occurred in a very short time. The wide extent of the deposit does not indicate that the animals were trapped in a narrow bay as sometimes happens to-day with whales and sharks. The skeletons all appear to be disassociated. The bones are not beach worn, but many of them are broken. Could the giant shark *Carcharodon branneri* have been responsible for any of this? Thus far tooth marks have not been found.

The bones occur in a fairly coarse, light gray, firm sandstone but are comparatively easy to extract. The stratum is very close beneath the unconformity which in this region separates the "Kern River Group" (of uncertain age) above, from the "Temblor" (lower Miocene) formation, below. The dip is to the westward at about twelve degrees and the strike approximately north and south.

For some reason no invertebrates appear to occur with the bones, but above there is a poorly preserved fauna and below lie very fossiliferous layers which furnished most of the Temblor species described by Anderson and Martin.

It is believed that sufficient excavating has been done to warrant the statement that at Shark Tooth Mountain lies the most valuable deposit of marine vertebrates thus far discovered in western North America. A thorough collection of the species there represented will undoubtedly shed much light on problems of world-wide correlation of geologic horizons; also, of equal interest to a large group of students is the possibility of here acquiring biologic knowledge bearing upon the little understood problems of the evolution of the marine mammals.

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[2] Univ. Calif. Publ. Geol., Vol. 5, No. 7, 1907, pp. 95–144; Univ. Calif. Publ. Geol., Vol. 7, No. 11, 1913, pp. 243–256 (with C. H. Beal); So. Calif. Acad. Sci. Bull., Vol. 22, pt. 2, 1923, pp. 27–68 (with Harold Hannibal).

[3] Univ. Calif. Publ. Geol., Vol. 13, No. 4, 1922, pp. 23–132.