graph line and for Kennan's actual route have been interchanged. WM. H. DALL

SOCIETIES AND ACADEMIES

THE CHEMICAL SOCIETY OF WASHINGTON

A SPECIAL meeting of the society was held on Saturday evening, May 21, at the Johns Hopkins University. Vice-president Skinner called the meeting to order and asked Professor Acree to preside. After a few words of welcome from President Ira Remsen, the following papers were presented:

Temperature Coefficients of Osmotic Pressure: Professor H. N. MORSE.

The report was upon the work of the last two years, during which the temperature coefficient of osmotic pressure has been under investigation. It was shown that in the case of cane sugar solutions ranging in concentration from 0.1 to 1.0 weight-normal—the ratio of osmotic pressure to calculated gas pressure is constant for any given concentration of solution, between 0° and 25°. In other words, that within these limits of concentration and temperature the osmotic pressure of cane sugar solutions obeys the law of Gay-Lussac for gases.

The Relation between Commerce and Scientific and Technical Work: Dr. H. F. BAKER.

Recent Work on the Absorption Spectra of Solutions: Dr. W. W. STRONG.

The absorption spectra of uranyl salts in solution consists of a series of about ten bands running from λ5000 to λ3200. Uranous salts have an entirely different absorption spectra, including bands in the red, yellow and green. It is quite difficult in some cases to obtain the uranous solutions entirely free of the uranyl salts, so that the uranyl bands will appear in the absorption spectra. But by adding hydrogen peroxide and photographing the absorption spectra as the uranous salt is gradually oxidized to the uranyl salt, it is quite easy to differentiate between the uranyl and uranous bands.

It has been found that the absorption spectra in different solvents are very different. As the solvent is gradually changed the uranous bands of one solvent gradually disappear while those of the solvent which is increasing in amount increase in intensity. The wave-lengths of these bands do not change. On the other hand, when the solvent is kept the same and one uranyl or uranous salt is changed into another salt by the addition of acid, the uranyl and uranous bands in general are shifted.

Fractionation of Crude Petroleum by Diffusion through Fuller's Earth: Dr. J. E. GILPIN.

Evidence was presented in favor of the view that one cause, at least, of the differences in petroleum from different localities is due to the degree and nature of the capillary filtration to which they are subjected in passing from their place of origin to the place where they are found.

After the meeting the society adjourned to the Johns Hopkins Club, where a smoker was held. The attendance at the meeting was sixty-two.

J. A. LECLERC,
Secretary

THE GEOLOGICAL SOCIETY OF WASHINGTON

AT the 231st meeting of the society, held on Wednesday, April 13, 1910, the following papers were read:

Regular Program

Solution and Cementation in Arid Regions: E. E. FREE.

Through soils and other unconsolidated surface deposits there is normally a double movement of water: downward percolation during or following rain, and upward rise by capillarity during periods of surface dryness. In the humid regions the downward percolation is far in excess and the various substances dissolved by the waters from the soil minerals are carried away into the drainage. The soil is subjected to leaching and retains no soluble materials except those held chemically or physically (as *e. g.*, by adsorption) in or on the solid particles of the soil. With decreasing rainfall the relative importance of the downward percolation decreases while that of the capillary rise increases. Under moderate aridity (semi-arid conditions) there is still a net downward flow, but it is insufficient to fully leach the soil and there is a tendency for the accumulation of the less soluble materials (usually lime carbonate) in the subsoil. Thus are formed the well-known lime-cemented subsoils, the "whitewash," etc., of the southwestern United States. The exact process of formation of the so-called "caliche" (the lime caliche—not the sodium salt caliche of South America), "tepetate," etc., is uncertain, but is probably similar. Under extreme aridity there is on many types of soil practically no final downward movement of water. The entire rainfall is stored in the subsurface layers and returned

to the atmosphere by direct evaporation or through plants. Here there is no leaching of even the most soluble salts. Instead they accumulate at or near the surface, forming the so-called "alkali soils." The same process acting on rocks instead of unconsolidated soils causes the surficial accumulation of manganese, iron, etc., and the formation of the "Schutzrinde" or "desert varnish."

Recent Experiments relating to the Transfer of Gold by Cold Dilute Mineral Waters: W. H. EMMONS.

The experiments which form the basis of this paper were made by Mr. A. D. Brokaw at the request of the speaker and by Mr. W. J. McCaughey and others. The experiments show that with cold dilute solutions approximating in composition the average of many mine waters, there is markedly great solvent action on gold when manganese is present. The best available data indicate that such solvent action is more than 250 times as great with solutions of manganitic salts as with solutions of cupric or ferric salts of similar concentration. Conversely, it has also been demonstrated experimentally that the precipitation of gold by ferrous sulphate is delayed if manganitic salts are present in the solutions.

It may be inferred from these experiments (1) that manganiferous gold ores should be more extensively leached of their gold in the upper portions of the lodes than deposits which do not carry manganese, and as a consequence that rich placers would be less likely to be associated with manganiferous than with non-manganiferous gold deposits; (2) that secondary enrichment in gold would extend to greater depths in manganiferous than in non-manganiferous lodes.

Using Lindgren's classification of the gold deposits of North America, a study of the literature was made to determine to what extent these conclusions were supported by field evidence. In general those deposits in which it has been supposed that gold was dissolved and reprecipitated by cold meteoric waters are characterized by manganiferous gangues. Nearly all of these are of late Cretaceous or Tertiary age.

Some Features of the Geology of the Navajo Reservation: H. E. GREGORY.

During the field season of 1909 a reconnaissance survey was made of that portion of Arizona and Utah between the Little Colorado and San Juan rivers. The topographic expression of this region is, in general, a plateau with an elevation of about 6,000 feet, reaching 10,400 feet at Navajo Mountain and dropping to 5,000 feet at the north and south where the Cretaceous beds have been removed. With the exception of Chin Lee Valley and the broad washes tributary to the Little Colorado, the stream channels are deeply intrenched. This fact, together with the scarcity of water and the occasional unfriendly attitude of the Navajo and Pahute Indians, makes the country somewhat difficult of access.

The strata in general are horizontal, with the exception of the monocline extending from Comb wash to Marsh Pass, the anticlines cut by the San Juan north of Monument Valley and the Defiance fold with accompanying hogbacks. Rocks of Triassic age are the most widely exposed, but the Carboniferous is seen in the San Juan canyon; the Moencopie (Permian?) covers considerable areas; the Jurassic is believed to be represented; the Cretaceous (Dakota and Colorado?) forms the Zilh-le-jini Mesa, as well as the mountains along the Arizona-New Mexico line; and the Tertiary caps Choiska and possibly also Navajo Mountain. The Moki Buttes south of Keams Canyon consist of necks and lava-capped mesas, remnants of flows of probably post-Pliocene time, which covered an area of approximately 600 square miles. Necks and dikes of Jurassic rock, usually basalt carrying peridote, are scattered irregularly over the reservation. Parts of Tunitcha and Lukachuckai Mountain are capped by lava and the Carriso Mountain is a mass of diorite of laccolithic origin.

The oil field twenty-five miles west of Bluff, Utah, and the coal field at and to the north of the Hopi villages are of commercial importance, but there is little basis for the reports of gold and silver deposits. Preliminary studies of this region indicate that by means of shallow and deep rock wells water may be developed in sufficient quantities to enable the Navajo, Pahute and Hopi Indians to increase the size of their flocks and the number of small fields suitable for the growth of corn.

AT the 233d meeting of the society, held on Wednesday, May 11, 1910, the following papers were read:

Regular Program

The Composition of the Soil Solution: F. K. CAMERON.

The soil solution is the result of geological processes, and is the natural nutrient medium for

plants. The organic constituents of the solution while important for plants, have only a minor interest for geology, but the inorganic constituents have a great importance for both. The soil solution is a medium for the transport of mineral substances, and the phenomena involved, which have been studied from an agronomic point of view, probably have also an importance in the study of secondary enrichments and similar problems.

Soils are far more heterogeneous than rocks. All the common rock-forming minerals are present in most soils, because of the actions of various mixing agencies, especially transportation by water and wind. These minerals dissolve quickly and are hydrolized by the water. This is the process of weathering. As fast as the hydrolized products are removed, the minerals continue to dissolve. If these were the only considerations, however, we should expect to find the same solution in all soils, under the same conditions of temperature, etc. But disturbing factors enter the problem. Prominent are the specific actions of dissolved carbon dioxide and oxygen. Most important are the phenomena of absorption, which are very marked with most soils. The distribution of a dissolved substance between an absorbent and a solvent is dependent upon the relative quantities present. Therefore the individual physical and chemical peculiarities of a soil will affect the composition of the soil solution. Experimental investigation, however, shows that the differences in the mineral content of soil solutions under similar climatic conditions are always relatively small. A consideration of the disposal of the rainfall in the soil shows that of the portion which enters the soil the greater part returns to the surface, and is of a higher concentration than the seepage waters. Consequently there is a tendency for the dissolved mineral substances to accumulate at or near the surface. This is actually realized in some arid and semi-arid regions. In humid areas, excessive amounts are washed into the drainage or back into the subsoil to again slowly move towards the surface with the capillary waters.

Some Evidences of Recent Subsidence on the New England Coast: CHARLES A. DAVIS.

Localities examined in Maine, New Hampshire, Massachusetts and Connecticut all show subsidence: (1) By the drowned coast characterized by fiords, wide estuaries, valleys extending out to sea and shore lines that have clearly migrated inland in recent times. (2) By the occurrence below tide-level, both inside and outside the present beaches, of submerged roots of trees of existing species, unquestionably in place as they grew. (3) By deposits of fresh-water peat now lying below tide-level and being actively eroded by the sea. (4) By positive engineering record that the masonry sills and floor of the old dry dock at Charlestown Navy-yard in 1903 were 0.71 foot lower relative to mean sea-level than seventy-two years previous, while they stood at exactly the same level in respect to points on solid ground. (5) By the salt marshes which occur wherever the gradient of the coastal region is slight. The structure of these marshes shows that they have been formed: (*a*) By gradual submergence of fresh-water deposits, which may include tree remains. (*b*) By the increase in thickness of the peat formed by the grasses growing on the present surface of the salt marshes, of which *Spartina patens* (Ait.) Muhl. and *Distichlis spicata* (L.) Greene, are by far the most generally distributed and important species.

These grow only in places covered not more than about four hours each day by salt water, *i. e.*, where they are just reached by ordinary high tides, while areas above and below these levels are occupied by entirely different plant species. The two species mentioned form a very characteristic and easily recognizable peat and its occurrence in beds ten or more feet thick, reaching continuously from the present surface of salt marshes to below low-water mark, with possibly fresh-water peat below this, is indisputable evidence that there has been subsidence equivalent in amount to the thickness of the salt-marsh beds, and at a rate exactly equivalent to the rate of upbuilding of the turf formed by the two grasses mentioned; this rate must be generally small.

No evidence has been found indicating that salt marshes lie in depressions, formed by indentations in the shore line which are in process of being cut off by barrier beaches, and which have been filled either by salt- or fresh-water vegetation; the structure of the deposits and the contours of the bottoms of the marshes examined being entirely against such an hypothesis.

Fox Hills Sandstone and "Ceratops Beds" in South Dakota, North Dakota and Eastern Wyoming: T. W. STANTON.

In the area adjacent to the Missouri River in northern South Dakota and southern North Dakota the latest marine Cretaceous formation is

the Fox Hills sandstone which was long ago described in this area by Meek and Hayden, who named it from its typical occurrence in the Fox Hills, which form a ridge between the Cheyenne and Moreau rivers and extend to the Missouri north of the Moreau. It is a shallow-water or littoral deposit of variable character usually not much over 100 feet thick in this area. It yields an abundant invertebrate fauna closely allied to that of the underlying Pierre, but with some distinctive species.

Above the Fox Hills sandstone there is a non-marine formation several hundred feet thick which is correlated with the so-called "Ceratops beds" of Wyoming, as it contains abundant remains of the dinosaur genera Triceratops and Trachodon and other reptiles belonging to the same fauna. It also yields fossil plants which have been identified as belonging to the flora of the "Lower Fort Union," to which horizon the "Ceratops beds" of other areas have also been assigned on the evidence of fossil plants. The Fort Union formation is supposed to be later than the Denver. Hence, if the "Ceratops beds" are Fort Union, where they rest on the Fox Hills there is a break in the sedimentary record which represents the Laramie, Arapahoe and Denver formations. In the examination of the area last summer by Geological Survey parties a somewhat eroded and channeled surface in the upper part of the Fox Hills sandstone was found at many points and was at first interpreted as an important unconformity giving evidence of the break above mentioned. The uneven surface is at the base of brackish-water bed full of shells of *Ostrea, Anomia, Corbicula,* etc., belonging to the same types and usually specifically identical with forms that occur in the Laramie. In the same bed with the brackish-water shells, and associated in such a way that they must have lived contemporaneously, a number of typical marine species belonging to the Fox Hills fauna were found. These include *Scaphites conradi* (Morton), *Scaphites conradi* var. *intermedius* Meek, *Scaphites cheyennensis* (Owen), *Lunatia subcrassa* M. & H., *Teredo* sp. and *Tancredia americana* M. & H.

This commingling of the marine Fox Hills species with the brackish-water fauna above the eroded surface was found at five localities distributed over an area about forty miles square. It proves that the erosion was geologically contemporaneous with the sedimentation and that the brackish-water bed really belongs to the Fox Hills. The wide-spread occurrence of this brackish-water bed at the top of the marine deposits and the absence of evidence of an unconformity immediately above it give strong evidence that there was a gradual transition from marine to land and fresh-water conditions.

In the southwest part of North Dakota on the Little Missouri, where there is a similar development of Fox Hills sandstone, the change from marine to land conditions is locally abrupt, so that lignitic land deposits rest directly on an uneven surface of the sandstone, but about 500 feet higher in the section there is an oyster bed with Cretaceous species of *Ostrea* indicating that the sea had not left the region until after a large part of the "Ceratops beds" was deposited.

In the Lance Creek area of Converse County, eastern Wyoming, the Fox Hills sandstone develops a thickness of about 500 feet and in its upper part contains thin coal beds and other evidences of land conditions intercalated in marine strata. At the top there is a brackish-water zone followed by the "Ceratops beds." The evidence is in favor of a gradual transition and practically continuous sedimentation rather than a long unrepresented interval.

The three areas discussed tell a story of gradually changing conditions near the end of the Cretaceous when the uplift of the Rocky Mountain region was draining the interior sea. The uplift was neither uniform nor continuous and the emergence above sea level could not have been simultaneous for all localities throughout the region. As the sea became shallow the effect of tidal currents and wave action was shown in irregular deposition, cross-bedding and local erosion, and when an area was elevated above tide the deposits formed were subjected to all the varying conditions of flood plains, deltas and marshes. It would depend on the configuration of the coast, the topography and drainage of the adjacent land and the rate of elevation whether at any particular locality the last marine bed would be covered by a brackish-water deposit or followed immediately by land conditions.

The bearing which the facts here presented have on the Laramie problem is self-evident. If there is a transition with practically continuous sedimentation from the Fox Hills sandstone into the "Ceratops beds" in the region discussed, then these "Ceratops beds" include the Laramie.

Francois E. Matthes,
Secretary