of subbituminous C rank with an average of 8650 Btu on an "as received" basis. The ash content is usually high, ranging from 5 to 25 percent and averaging about 10 percent. When exposed to the air, the coal slacks readily because of its high moisture content, which ranges from 16 to 35 percent.

Nearly 15,000 ft of drilling between 1949 and 1951 yielded information on the extent, thickness, physical characteristics, and reserves of the district's coal. This information, combined with information obtained by mapping and prospecting, shows that the district contains more than 3.5 billion short tons of coal, of which about 40 percent is considered recoverable with present mining methods. During 1951, four mines were operating in the district and produced a total of 52,500 short tons of coal.

As early as 1901, the presence of a thick sequence of marine sedimentary rocks in the Centralia-Chehalis area encouraged the search for oil and gas. Since that date, there has been intermittent exploration, and prior to July, 1952, 14 test holes were drilled within the area. The results of this drilling have not been encouraging, but small shows of gas have been reported. The McIntosh formation of late middle Eocene age, which includes a thick sequence of marine siltstone with interbedded sandstone, is considered the most favorable formation to test for oil and gas. Seven of the test wells drilled in the area are reported to have penetrated rocks of the McIntosh formation. Shows of gas were reported in all these test holes; and a show of oil was reported from a well drilled on the Lincoln Creek uplift, in the western part of the mapped area.

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A Dehydrator for Direct-Current Amplifiers

THE direct-current amplifier is extremely sensitive to minute variations in grid voltage. This sensitivity is required for operation but also is a property that introduces considerable error into experimental data obtained with its use under certain conditions. The phototube amplifier in the Beckman DU Spectrophotometer was often found to be unstable in humid weather, as indicated by continuous fluctuations in the galvanometer needle. Since the battery voltage source was constant, the instability was assumed to be caused by variations in the grid voltage. The latter could result from a variable d.c. ground path in parallel with the 2000 megohm grid resistor (the phototube load resistor). The grid voltage variation proved to be due to moisture condensed on the grid resistor, as shown by stabilization after drying. Although the cartridge containing silica gel may successfully perform this function, the following system was found to be more rapid and effective.

Two of the mounting screws on the front panel of the amplifier case were replaced by longer screws that had been drilled lengthwise to permit the passage of air. To these screws were connected the intake and outlet hoses of a recirculating drying system that consisted of an electric double-action piston pump to circulate the air, a cotton filter to remove any oil from the pump, and a tube containing the desiccant (indicating silica gel). The color change from blue to pink indicates when the tube of desiccant must be changed. Several tubes of desiccant may be kept on hand and, when necessary, dried in an oven or by perfusion with hot air. The pump should be turned on about an hour before the amplifier is to be used, unless the atmospheric conditions have been especially humid, in which case more time may be necessary.

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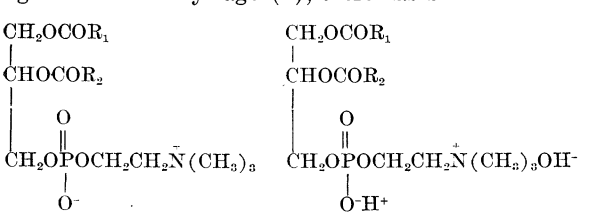
Depiction of the Lecithin Molecule

DESPITE the fact that experimental evidence serving to establish the zwitterion structure (I) of lecithin on a firm basis was provided by a number of investigators about 20 yr ago (*1*), there has been considerable reluctance to discard the archaic and misleading depiction II. Thus, the structure of lecithin continues to be represented as II (or even more naive representations in which the nitrogen atom is joined to five substituents) in current literature and in otherwise modern and up-to-date biochemistry textbooks.



I II

In a recent series of papers, Baer (*2*) has spoken more and more positively in favor of the old representation II on the basis of the fact that ultimate analyses of crystalline lecithins and structurally related substances indicate the presence of the elements of a molecule of water in addition to those predicted from a consideration of formula I. Baer's painstaking compilation of analytic data on a number of lecithins isolated from natural sources, in addition to those based on his own elegantly prepared synthetic products, would seem to leave little doubt that such substances characteristically incorporate a molecular equivalent of water within their crystal lattices. However, the presence of what is usually termed "water of

crystallization" in crystals of substances of polar character is not unusual and is not customarily assigned any special structural significance. In any case, the simultaneous occurrence of both hydrogen and hydroxyl ions in the lattice of a crystalline substance is simply untenable.

The question of how to represent a single molecule of a substance of this type, which would be expected to be bound more or less strongly by electrostatic forces to other polar molecules of the same or different constitution in its immediate vicinity, is difficult to answer with finality because of its doubtful real significance. But for pedagogic reasons, if for no other, depiction of the hypothetical isolated lecithin molecule as a zwitterion (I) cannot be seriously questioned as being superior to those others that have been used in the past.

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2. E. Baer. *J. Am. Chem. Soc.* **75**, 621, 5535 (1953).

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Ground Water in the Navajo Country

IN the semiarid Navajo country the ever-urgent problem is the development of adequate water supplies. The Navajo country in northeastern Arizona, northwestern New Mexico, and southeastern Utah occupies about 25,000 mi². This region is a high plateau that has considerable relief expressed by mountains, mesas, buttes, and deeply cut canyons. Most of the area lies between 5000 and 7000 ft above sea level.

The climate varies widely according to altitude and topography. The average yearly rainfall ranges between 6½ and 13 in. However, the yearly precipitation is as little as 1½ in. in the desert zones. The streams, which are mostly intermittent, drain radially from the central part of the area into the San Juan River on the north and into the Little Colorado River on the south. A few stretches of some streams have perennial flows sustained by snow-melt in the mountainous areas and by springs discharging from water-bearing rocks.

The occurrence of ground water in the Navajo country is directly related to the complex stratigraphic relationships of the geologic formations and their structural attitude. There are about 8000 ft of sedimentary rocks, which consist mostly of sandstone, siltstone, claystone, mudstone, and limestone. These rocks range in age from Pennsylvanian to Recent. Sandstone makes up about 30 percent of the rocks and comprises the principal aquifers in the region. The mudstone and claystone are impermeable to water and form the confining media which hydraulically separate the water-bearing formations.

There are a number of sandstone aquifers in the region from which ground water can be developed. In ascending order, these consist of the DeChelly sandstone member of the Cutler formation and the equivalent Coconino sandstone, of Permian age, the Wingate standstone and Navajo sandstone of Early Jurassic (?) age, the Entrada and Cow Springs sandstones of Late Jurassic age, the upper part of the Morrison formation of Late Jurassic age, the Dakota sandstone of Cretaceous age, the sandstones of the Mesaverde group of Late Cretaceous age, and sandstone of Tertiary age. The DeChelly and Coconino, the Navajo, and the Mesaverde yield the largest amounts of water in the Navajo country. Sandstones of the DeChelly and Coconino constitute the most widespread aquifer. However, development of gound water is feasible only in a fourth of the area of its occurrence, owing to its great depth below the surface, beyond the practical reach of wells, and to the high content of sodium chloride in the water in the deeper parts of the structural basin. The Navajo sandstone is a large wedge-shaped deposit that occurs only in the northwestern part of the region and pinches out to the southeast. This aquifer is within the practical reach of wells, and the water is of excellent quality for domestic and stock purposes. The sandstones of the Mesaverde group occur in the central and eastern parts of the region. Each of these sandstones is a separate aquifer, and in many areas they yield water of widely different quality. The best water is encountered near the recharge area, and as the water moves down dip toward the central portion of the basin it becomes highly mineralized.

In the Navajo country, the ground-water supplies are small when compared with the available supplies in such areas as southern Arizona and California. The problems of mineral contamination further reduce this usable amount to a half or a third of the amount of water available. Development of ground water for irrigation purposes is not feasible except in limited quantities for small garden plots. It seems desirable to obtain enough information to set up a "water budget" —an account of the disposition of all the rainfall—in order that information may be available on the total quantity of usable water, to serve as a basis for a stable economy for the Indian peoples in this region.

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Mesozoic Charophyta

THE Charophyta are green algae that live in quiet bodies of fresh or brackish water. They are common plants of world-wide distribution but are of little economic value and are not well known, even among botanists. Some species secrete calcite within the cells and have contributed extensively to nonmarine marl and limestone formation. On the death of the plant, the vegetative parts become broken and entangled, or the calcite disintegrates into a fine-grained mud, but the gyrogonites—the minute, sinistrally spiraled, ovoid