the blood passage through the lungs into the left heart.

The usefulness and reliability of hematological work with blood specimens from the mouse tail is not affected by these data, as the ratio between leukocyte counts from the tail and the heart (T/H) was shown to be constant in all mice of the same (C57-6) strain (Table 1) and of another strain (CFW) (Table 2, line 1). Thus, reliable data on leukocyte concentration in the blood of the mouse can be obtained by taking blood from the same area of the tail or from the same section of the heart in all animals.

Table 2 shows that "equalization" of leucocyte counts was achieved as a decrease of tail counts without consistent and significant changes in the heart blood, thus indicating that the difference in counts was due to leukocyte concentration in the tail capillaries. It should be specified that equalization of counts by moranyl and heparin was observed only when their anticoagulant effect was well marked, thus indicating a relationship between these two effects. The blood of heated mice also showed considerable increase of clotting time in the specimens used for leucocyte counts. It follows that the "equalizing" effect of anticoagulants and perhaps also of total body heating on leukocyte counts cannot be attributed to reduction of resistance in peripheral vessels, (*2, 3*) and therefore the difference in tail and heart counts cannot be explained only by vascular phenomena as was suggested in experiments on rats (*2–4*). It may be presumed that some specific characteristics of fluid exchange between the vessels and the tissues in the tail of the mouse and the rat, but not of the dog (*6*), should be considered. The problem merits a special study on broader lines.

Summary. Leucocyte counts in blood specimens taken from various areas of the vascular system of the same mouse have shown that the leukocyte concentration decreased progressively during passage of the blood from tail capillaries through the femoral vein and right heart, to the left heart; red blood cell counts and leukocytic formula were found the same in all specimens. The ratio T/H (leukocyte number per centimeter in the tail and the left heart) was relatively constant (av., 5.7; variation extremes 4.3 and 6.5) for CFW and C57-6 mice. This ratio was decreased and thus the counts were equalized by the treatment of mice with total body heating, ether, or anticoagulants. For practical purposes, the relative constancy of the T/H ratio in all mice examined showed that reliable data on leukocyte concentration in the blood of the mouse can be obtained by taking blood from the same area of the tail or from the same section of the heart in all mice.

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Communications

The White Pine Copper Deposit, Ontonagon County, Michigan

COPPER, typically as the mineral chalcocite, occurs over many square miles near White Pine, Ontonagon County, Mich., in the lower part of the Nonesuch shale. This copper deposit and the famous deposits of native copper in the Portage Lake lava series on the south shore of Lake Superior are distinctly separated, geographically by a distance of 45 to 70 mi and stratigraphically by the thickness of the Copper Harbor conglomerate.

The Nonesuch shale, of late Keweenawan age, is about 600 ft thick and is composed largely of gray siltstone. It overlies the 2300–5500 ft of red sandstones and conglomerates of the Copper Harbor conglomerate, which in turn overlies the middle Keweenawan Portage Lake lava series.

The copper-bearing zone at White Pine, mostly in the lower 20–25 ft of the Nonesuch shale, in local usage is divided into four stratigraphic units. These are, in ascending order, the lower sandstone (uppermost 4 or 5 ft of the Copper Harbor conglomerate), the parting shale, the upper sandstone, and the upper shale (lowermost beds of the Nonesuch shale). In the upper and parting shales the sequence of beds is almost identical and suggests cyclic sedimentation. This sequence and the distribution of sedimentary facies are attributed to two submergences, separated by an emergence, of a deltaic area.

Practically all the copper occurs in the upper and parting shales except in a small area near the White Pine fault, where it is abundant in the upper and lower sandstones. It is present in 5 different layers in amounts that average from 1 to 3 percent. The total amount of copper in each bed is generally higher where the bed is thick rather than thin, and thickness, in turn, seems to be greatest in areas that were hollows, away from the main channel or channels of the ancient delta. Copper content of the shale beds typically decreases as their sand content increases. The extent of individual copper-bearing beds 1–3 ft thick is measurable in square miles.

The local occurrence of copper in the upper and lower sandstone beds can be reasonably explained as the result of hydrothermal transportation from the White Pine fault up the dip of the relatively permeable sandstone to the crest of an adjacent anticline. Distribution of copper in the parting and upper shales, on the other hand, seems to be completely independent of local structure, faults, and rock permeability. For the area as a whole, the control is entirely lithologic and stratigraphic. Probably the copper was dropped into or precipitated within the original mud; it may conceivably have replaced, with exquisite detail, something else that was so deposited.

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Ammonite Accumulations in the Cretaceous Mowry and Aspen Shales

THE Mowry and Aspen shales, derived in part from the airborne ash of a series of volcanic eruptions, extend from northern Colorado through Wyoming to central Montana. Some ash falls were changed to a clay (bentonite), but the greater part, now more or less silicified, ranges from a rather hard shale where much nonvolcanic detritus is present to a dense porcellanite. At some places the less silicified parts contain calcareous concretions from 8 cm to as much as 2 m in diameter.

The formations are noted for their well-preserved but scattered scales and bones of fishes; other fossils are very rare. At a few places abundant pelecypods, with few ammonites and gastropods, are preserved in porcellanite. Completely flattened molds of ammonites, mostly in porcellanite, have long been known, but because of their preservation are difficult to evaluate. Unflattened ammonites were known from a few localities in northern Wyoming and Montana, but were erroneously attributed to other formations; recent field work has shown that these ammonites are also from the Mowry shale.

The unflattened ammonites are all in calcareous concretions that are alike in certain features. They are usually in a stratum with many others that are nearly barren of fossils, as are also the enclosing rocks. They contain, in parts of the concretions, fish remains so abundant that they form the matrix of the invertebrates. They also contain carbonized wood and a few isolated bones of pterodactyls and marine reptiles.

The ammonites are unoriented and unsorted. Variant shells, from slender costate to stout spinose, are associated, and immature forms 10 mm in diameter are mingled with others 50 mm or more in diameter. In most specimens the living chamber that in life contained the soft parts is missing or crushed, and in many the septate part has been damaged. A phenomenal number of ammonites is present in some of the concretions. One found near Winnecook, Mont., yielded 1300 specimens of gastroplitid ammonites (the largest 270 mm in diameter) and 230 engonoceratids. A second, from Teigen, Mont., yielded 3800 gastroplitids (the largest 400 mm in diameter) and 400 engonoceratids. And a third, from Cody, Wyo., produced 2400 gastroplitids (to 400 mm in diameter) but no engonoceratids. For none of these concretions (each about 6 ft in diameter) is the collection probably as much as half the original content of the concretion. In view of the rarity of the scattered specimens of flattened ammonites in the ordinary beds of the Mowry and Aspen shales, what conditions would produce in a single concentration a mass of unflattened ammonites, fish remains, and carbonized wood? And why would no fossils be found in the many other concretions nearby at that level? The persistence of fossil wood suggests currents that could sweep the shells together, but there has been little sorting, such as currents might produce, and it is difficult to see why all the shells would be concentrated by currents in the small area of one concretion. If ammonites lived in swarms, the mass annihilation of a swarm by some sudden volcanic event could perhaps result in its preservation in one restricted spot, but surely there would be a few stragglers somewhere in the vicinity. To us the most attractive speculation is that these concentrations are aggregations of the fecal matter of some large carnivore (reptile, fish, or cephalopod), a thesis that would explain the damage to the shells, the lack of complete individuals, the lack of sorting, and the disarticulated condition of the fish remains. It would be necessary to postulate that the carnivore fed almost entirely on ammonites and fish and perhaps that, as the living octopus, it frequented a sort of lair, to which it carried its prey for leisurely consumption and in which the mucus-bound fecal matter could accumulate.

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Polarographic Determination of Tungsten in Rocks

THE polarographic determination of tungsten has the advantage of being less tedious and more rapid than the classical gravimetric methods usually used in analyzing rocks and ore concentrates.

The current voltage curve for tungsten, described by Lingane (*1*), using concentrated hydrochloric acid as the supporting electrolyte, gave inconsistent results when applied to rock samples. This inconsistency may be attributed to the formation of polytungstates, and the particular polytungstate formed in a given sample depends on: (*a*) the constituents of the sample, (*b*) the chemical treatment of the sample, and (*c*) if tungsten standard was added to the sample, the manner in which it was added.

However, a new polarographic wave for tungsten in a supporting electrolyte of 4.6 molar hydrochloric acid and 0.1 molar tartrate gave satisfactory current-voltage curves, regardless of the constituents of the sample and regardless of whether the tungsten is that present in the sample or that added as standard to the sample. Tungsten is reduced stepwise; the half-