Since the collection of the first sample of coffinite, we (*2*) and others have identified this mineral from more than 15 uranium mines in the Triassic and Jurassic sediments of the Colorado Plateau. The new mineral has also been collected from mines in the Tertiary sediments of the Gas Hills area, Fremont County, Wyoming, from mines in the pre-Cambrian metasediments near Globe, Arizona, and from the Copper King mine, a vein deposit in Larimer County, Colorado, as well as from several foreign localities.

Coffinite is a major uranium mineral in the unoxidized ores of the Colorado Plateau. It is commonly black with an adamantine luster. In transmitted light, coffinite is opaque except on thin edges, but in fragments of minus 325-mesh size (less than 44 μ), it is pale to dark brown. It is closely associated in the Colorado Plateau with carbonaceous material, uraninite, black vanadium minerals, pyrite, quartz, and clay. The mineral is very fine grained, and a clean separation of it from the organic and other fine-grained material has not been successful to date. Its fine-grained nature is also shown by broadened lines in its x-ray diffraction powder pattern. The highest specific gravity of coffinite concentrates relatively free of organic contamination is 5.1. A fuller description of coffinite is in preparation.

Coffinite is best identified by its x-ray powder pattern. It is tetragonal ($a_0 = 6.94$ A and $c_0 = 6.31$ A for material from the Arrowhead mine, Mesa County, Colorado) and has strong lines at 4.66, 3.48, 3.47, 2.65, 2.64, and 1.80 A. These measurements vary slightly from sample to sample. The x-ray powder pattern is similar to that of thorite ($ThSiO_4$), but the mineral contains no thorium.

Several samples of the purest coffinite concentrates have been analyzed by A .M. Sherwood. These analyses show as much as 61 percent uranium with varying amounts of silicon, arsenic, and vanadium. There is not sufficient $SiO_2$ present in these samples for the mineral to be a simple uranous silicate. Detailed leaching studies have shown that arsenic, vanadium, and aluminum are not essential constituents.

Infrared analyses on minus 400-mesh, vacuum-dried coffinite by R. G. Milkey (U.S. Geological Survey) show strong absorption in the regions between 2.8 and 3.1 μ. These two absorption bands are characteristic of bonded OH groups with some unbonded OH and isolated $SiO_4$ tetrahedra, respectively. The deficiency of silica and the presence of bonded OH groups suggest that $(OH)_4^{-4}$ has substituted for $(SiO_4)^{-4}$. Frondel (*3*) found that this substitution exists in thorogummite, $Th(SiO_4)_{1-x}(OH)_{4x}$, which is the hydroxyl-containing variant of thorite in which $(OH)_4^{-4}$ substitutes for $(SiO_4)^{-4}$. The proposed chemical formula for coffinite is $U(SiO_4)_{1-x}(OH)_{4x}$.

Attempts to synthesize $USiO_4$ by G. W. Morey (Geophysical Laboratory, Carnegie Institution of Washington), Clifford Frondel (U.S. Geological Survey and Harvard University), and S. M. Lang (National Bureau of Standards), as well as attempts in the U.S. Geological Survey laboratories, have not been successful to date.

A. D. Weeks, M. E. Thompson, and A. J. Gude, III, of the Survey, and Frondel have also worked on this problem. This work is part of a program being carried on by the Survey on behalf of the divisions of raw materials and research of the U.S. Atomic Energy Commission.

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**References and Notes**

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## The Measurement of Rotational Speed with a Sonometer

A simple device for the measurement of centrifugal speeds from 50 to 220 cy/sec without contact between the instrument and the rotating object is described here. An application of this device in measuring the speed of the Servall centrifuge (Model SSI), as used in recent experiments on brain particulates in this laboratory (*1*), is also given (Fig. 1).

A permanent magnet *M*, made from a piece of razor blade, is affixed with adhesive tape to the upper surface of the screw that holds down the lid of the rotating centrifuge bowl. The blade does not disturb the balance of the centrifuge. On level with the magnet, a small electromagnetic coil *C* is mounted on the cage of the centrifuge in such a position that the poles of the permanent magnet, when rotated, pass close to the soft-iron core of the electromagnet. Thus, the elements of an alternating-current generator are formed, with the magnet as rotor and the coil as the stator. The alternating current produced is amplified by an audio-frequency amplifier *A* and passed through the wire of a sonometer which, in turn, passes between the poles *N* and *S* of a permanent magnet. The string (a

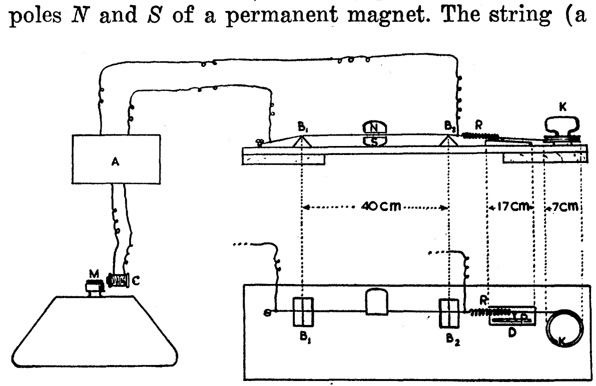


Fig. 1. Diagram of sonometer.

40-cm length of copper wire, 0.3 mm in diameter) is attached at one end to a screw that serves for readjustment of the sonometer in case it gets "out of tune," then passes over two bridges, $B_1$ and $B_2$, made of glass rods; at the other end it is attached to an expansion spring $R$, which may be stretched by turning the knob $K$ of a wooden pulley. The spring should be able to carry a load of 1 kg. A pointer $P$ is attached to the movable end of the spring over a scale $D$. The latter is calibrated in terms of the tension in 100-g units by means of weights varying between 50 and 1000 g.

When the tension is so adjusted that the natural period of the wire is the same as that of the alternating current, the wire begins to vibrate. The frequency of vibration $f$ of the sonometer wire is expressed in terms of cycles per second. Thus,

$$f = \frac{1}{2L}\sqrt{\frac{T}{m}},$$

where $T$ is the tension in the wire in dynes, $L$ is the length of the wire, and $m$ is its mass-per-unit length. If a tuning fork of known frequency is used to measure $f$, then $L$, $m$, and an instrument constant $c$ may all be incorporated in one constant $k$. Hence, $f = k\sqrt{T}$.

In order to calibrate the instrument, $k$ is first determined as follows. The tension in the wire is adjusted until it resonates with the vibrating tuning fork (of frequency $f$) whose base is held on the wooden framework of the sonometer. The value for $T$ is indicated by the pointer $P$, the scale having been calibrated previously with weights. The known values are then substituted in the equation.

When the speed of rotation is measured, the tension in the sonometer wire is varied until the wire vibrates with maximum amplitude. Owing to the small intensity of the current coming out of the amplifier, the wire vibrates only at the natural frequency of the current. It is possible to measure speeds higher than those registered on the scale since the harmonics of the vibrating wire can be obtained by varying the tension. In such cases the frequency reading on the scale should be multiplied by the number of internodes observed.

The accuracy of the instrument was tested stroboscopically, and the deviation between the two methods was found to be about 1 percent. This error is greater than that of more complex instruments described in the literature (*2*), but the sonometer described has the advantage of simplicity and may be constructed with ease in any laboratory.

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## Uncritical Citation of Criticized Data

In an earlier communication, Zirkle (*1*) discussed the citation of fraudulent data, particularly the refuted work of Paul Kammerer, the Viennese zoologist who claimed to have proved that acquired characteristics are inherited. Zirkle pointed out that reports of Kammerer's work are beginning to creep back into current literature, and that, either knowingly or unknowingly, some of those who cite his findings have failed to mention the damning criticisms.

Zirkle's note suggested to us somewhat analogous situations in the field of psychology. Therefore, we attempted to determine whether two much disputed studies (fraud was not alleged for one or definitely proved for the other) relating to the stability of the IQ are being quoted in current psychological textbooks without criticism.

In 1938 a group of experimenters at the University of Iowa published a monograph (*2*) that showed large increases in the IQ's of a group of preschool orphans who were given the opportunity to attend nursery schools. Beth L. Wellman popularized their findings by writing reports for several periodicals (*3*). The "Iowa studies of raising the IQ" were subsequently criticized, primarily for erroneous statistical procedures employed, by Simpson (*4*), Goodenough and Maurer (*5*), and McNemar (*6*). Although Wellman attempted to refute these criticisms (*7*), many psychologists found her defense unconvincing.

Similarly, in 1946 there appeared in *Psychological Monographs* (accompanied by an editorial note with regard to its controversial nature) a study by Bernardine G. Schmidt (*8*) that reported phenomenal increases in the IQ's of children originally classified as feeble-minded. She popularized her conclusions in several journals (*9*) and became the object of much publicity (*10*). Then Kirk played detective and unearthed many aspects of Schmidt's work that seemed to invalidate her most important claims (*11*). When Goodenough (*12*) later reviewed Schmidt's monograph, her remarks were for the most part quite critical. Nolan (*13*) published a rather informal survey of opinions of several leading psychologists who had attempted studies similar to Schmidt's concerning the validity of her findings. The general consensus was that her investigation had many crucial flaws.

In searching through 21 textbooks in child, educational, and general psychology, all published not earlier than 1949, we found a number of references to the controversial studies of Wellman and Schmidt. Approximately one-half of the books did not mention either of the investigations, and it was gratifying to find that 73 percent of the writers who did refer to them also included criticisms. However, three educational psychology textbooks (*14*) cited the Iowa studies as evidence of the instability of the IQ, but did not criticize them. All writers who referred to Schmidt's study also made critical remarks concerning it.

The uncritical citation of disputed data by a writer, whether it be deliberate or not, is a serious matter. Of course, knowingly propagandizing unsubstantiated