SCIENCE NEWS

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THE DEPOSITION OF ZINC ON COPPER

THE discovery that the surface of polished metal is liquid promises to lead to a new method of metallic plating. This advance may result from a few seconds of startled watching of the picture thrown on a screen by an electron "microscope."

In a few fleeting moments, Professor G. I. Finch and two research students, Dr. A. G. Quarrell and J. S. Roebuck, at the Imperial College of Science, London, found definite proof of a hypothesis put forward many years ago by the late Sir George Beilby, the director of fuel research for the British Government during the world war.

Professor Finch and his colleagues were working with a special type of instrument called the electron-diffraction camera. This wonderful "camera," in which a stream of electrons throws an image on a fluorescent screen, in effect magnifies the object 30,000,000,000 times compared with the 2,500 or 3,000 times of most ordinary microscopes.

They were experimenting with a piece of polished copper, which was being bombarded with particles of zinc emitted from a zinc wire rapidly heated in a vacuum by an electric current. Many times before similar experiments had been made, study of the shapes of crystals thus deposited on metal surfaces. But this happened to be the first time that the bombarded metal had been polished.

As usual a diffraction pattern was shown on the fluorescent screen—a score or more of bright circles. But to the intense surprise of the watchers this pattern gradually weakened, became less bright and within three seconds had completely disappeared. They tried again. A second, a third and a fourth film of zinc was projected onto the copper. Each disappeared in the same way as the first, but each diffraction pattern lasted longer than the preceding one, until the twelfth pattern remained—meaning that the twelfth layer had stood fast.

"What this means," Professor Finch told the Science Service correspondent, "is that the incoming crystals of zinc were being dissolved in the liquid layer of the polished copper. Like snowflakes falling on water, the crystals rest for a moment on the surface and then disappear.

"That this should happen at all is presumptive evidence that the top layer of the polished metal is liquid. But the real proof is that with this experiment we can only observe an electron pattern when the zinc crystals are on the top of the liquid surface, and not before they arrive or after they have disappeared. No pattern means no crystals—which is what physicists call the 'solid liquid' state.

"The twelfth layer of crystals standing fast simply means that the liquid copper has reached its saturation point, has dissolved all the zinc that it is capable of holding. This is supported by the fact that when the zinc bombardment was turned on polished iron the zinc layer stood fast at only the second attempt. Zinc is less soluble in iron than in copper, and so one would expect the liquid layer of iron to be saturated more quickly."

Professor Finch has found that the films of zinc or other substances thus deposited on polished metal can never be completely removed without removing the metal itself. An alloy has, in fact, been formed. This process, which he terms "vacuum-plating" has, he believes, great commercial possibilities as a substitute for electroplating. A systematic investigation is now being started.

THE ABUNDANCE OF THE RARE GASES

WHY some elements are more abundant than others is a question that has long interested scientists because of its importance in any theory of the evolution of the elements. Certain relations to atomic numbers have been found, and many hypotheses have been proposed.

However, it does not seem to be always the most stable atoms that survive the atomic struggle for existence. For instance, Drs. W. M. Elsasser and R. Guggenheimer point out, as reported in the *Comptes Rendus* of the French Academy of Sciences, that the noble gases neon, argon, krypton, xenon, which disdain to form any chemical combinations whatever with other elements and are among the most stable of the atoms, are exceedingly rare on this earth—whereas the elements which stand on either side of them in the periodic table, the metals sodium, potassium, rubidium, caesium on one side, and the acid forming halogens fluorine, chlorine, bromine, iodine on the other side, which are chemically the most active elements known, are millions to billions of times more abundant.

By the loss of an electron from the nucleus, each gas is stepped up one atomic number and transmuted into the metal which stands next to it in the table—neon to sodium, argon to potassium, etc. By the loss of a positron, or of an alpha particle and an electron, from the nucleus, each is degraded one atomic number into the halogen just preceding it in the table—neon to fluorine, argon to bromine, etc.

Drs. Elsasser and Guggenheimer suggest that originally these gases were abundant in the earth's atmosphere, but that by millions of years of bombardment by neutrons they have been converted into these other elements, which have been incorporated in the earth's crust where we now find them in abundance, while the atmosphere has been almost completely denuded of the noble gases.

This is considered an attractive hypothesis, which in its presentation to the French Academy had the sponsorship of Dr. Francis Perrin.

HEARING SOUNDS OF DIFFERENT PITCH

THE highest notes of the violin may reach your brain in an entirely different way from that of the low rumble of the bass drum. Evidence for a dual mechanism of hearing for high and low tones was presented to the New

York Branch of the American Psychological Association by Dr. Clifford Pearce, of Brown University.

Dr. Pearce's experiments were based on the fact that when the ear is fatigued by hearing a tone for a period of time, the tone or others sounded will not appear so loud. But when the ear is fatigued by a high tone, the hearing of high tones is affected more than is the hearing of low tones. And, likewise, when a low note is used to fatigue the ear, the hearing for low notes is affected more than for high notes. These results indicate the likelihood of a separate process of hearing for high and low pitches.

Such a dual mechanism has been suggested as a result of research previously conducted at Harvard and elsewhere, and is a sort of compromise between conflicting theories of how hearing takes place. One theory, the telephone theory, teaches that the frequency of the sound wave, which gives it its pitch, is duplicated in the frequency of the nerve impulse in the auditory nerve. This theory fell down when it was established that the auditory nerve can not transmit frequencies as high as many of the highest audible sound frequencies.

The second theory holds that different parts of the membrane of the ear are tuned to various pitches. When a sound comes to the ear, only the correctly tuned section of the membrane vibrates, and the nerve attached to that particular section is set in action. The high tone is recognized as different from the low tone, because it comes by a different route to the brain.

The newest theory holds that the telephone theory may be correct for low tones, and the place or resonance theory for the high pitches. This dual theory was the one tested by Dr. Pearce.

MANNER OF BREATHING AND OXYGEN CONSUMPTION

SCIENCE has turned to the mysticism of India to discover new facts about breathing. For nearly two years a young Hindu graduate student at Yale University, K. T. Behanan, returned to his native India to subject himself to the practices of the cult of Yoga in the hope that psychology and physiology would be benefitted. In this scientific excursion into routine practices associated with mysticism Mr. Behanan had the guidance and cooperation of Dr. W. R. Miles, of the Yale Institute of Human Relations. Dr. Miles and Mr. Behanan presented to the American Physiological Society preliminary results for the graphic pictures of these breathing patterns and careful determinations of the oxygen used by Mr. Behanan's lungs while he performed the intricate breathing exercises taught him by a noted Yoga practitioner.

Unusual breathing methods are a part of the rigorous religious regimen of the Yoga cult which dates from the third century B. C. Extreme variation from ordinary breathing habits are learned by Yoga disciples and used daily for periods of from one to several hours.

Because peculiar breathing methods are not confined to these religious mystics but are used in sports and industry, their physiological significance may have theoretical or even immediate practical application in our modern Western world. Pearl divers often are able to hold their breath for unusual lengths of time, over-ventilating their lungs with unusual amounts of oxygen. Expert swimmers develop breathing rhythms that give them record-winning advantages.

Kapalabhati, Ujjayi and Bastrika were three of the breathing exercises learned by Mr. Benhanan and practised by him for twenty months of adherence to the Yogic routine.

The Indian mystics use Yoga breathing exercises in order to induct themselves into the proper physiologic state for beginning their particular type of religious contemplation.

Physiologists were interested in Dr. Miles's report that the oxygen consumption of Mr. Behanan during the Yoga breathing was increased about twenty per cent. over that of his ordinary breathing. This was followed by a reduction of about four per cent. during 15 to 20 minutes succeeding the exercise. This Yogic breathing was at the rate of one breath per minute or slower.

MENTAL TESTS AND AFRICAN CHILDREN

THE experience of giving mental tests to 50 Sousous children, primitive West-African Negro youngsters in the isolated all-native village of Koba, French Guinea, was described to the New York Branch of the American Psychological Association, in a report by Drs. Elaine F. Kinder, psychologist of New York, Solomon Machover, of Bellevue Psychiatric Hospital, and Henry W. Nissen, of Yale University.

The tests were given with the aid of an interpreter who had been previously trained in the technique. All sorts of difficulties were encountered, but chief amongst them was that the children, although apparently of normal brightness, simply could not comprehend what they were to do with many of the tests. These children have had very little contact with the culture of modern civilization, and the experimenters conclude that this isolation accounts for the fact that they did well on some tests, but could not even attempt others. None of the tests used was dependent upon the use of language.

In order to arrive at some sort of estimate of intelligence quotient, or the children's "brightness for their age," it was necessary to guess at the chronological age of the youngsters. No records were kept by the tribe, and although the tribal chief and the parents were questioned, they could not help much. Consequently, a combined estimate by the examiner, the interpreter, and a white mechanician attached to the laboratory was used.

The difference between the scores made by these primitive children and Negro children in the United States is to be accounted for by the vast differences between the life and culture of America and of Africa, the investigators conclude. This is confirmed by the fact that the test quotients of the younger children were consistently higher than those of the older ones.

PSYCHOLOGICAL TESTS FOR MUSICAL ABILITY

THE student fired with ambition to become a concert musician or to earn his living by playing in an orchestra, yet lacking in the certain something that makes for

success along these lines, may be saved from the bitter heart-ache of failure by tests reported at the meeting of the New York Branch, American Psychological Association, by Dr. Hazel M. Stanton, director of the musical talent service, of the Psychological Corporation.

Six tests of musical capacity and a comprehension test form the battery of examinations with which Dr. Stanton is able to classify students entering on a music course according to whether they are safe "risks," probable, possible, doubtful, or discouraged.

During the course of an eight-year study reported by Dr. Stanton to the psychologists, she had used the tests to predict the probable achievement of students entering on a degree course in a music school. She found that of the "safe" group, 60 per cent. completed the course successfully and graduated; 42 per cent. of the "probable" graduated; only 33 per cent. of the "possible"; 23 per cent. of the "doubtful"; and only 17 per cent. of the "discouraged" reached the goal. In other words, about 80 per cent. of those making the poorest scores on the test never succeed in completing their course, and naturally have very little chance of professional success after graduation.

"The students in the lowest groups are poor risks for a music degree, for themselves as well as for the music schools; they should know these facts and not be deceived," Dr. Stanton concluded. "For many of them music should be only an avocation."

ITEMS

A CONSPICUOUS spot on the surface of the planet Jupiter has been discovered by a Berlin amateur astronomer and confirmed by observations made through the great refracting telescope of the Potsdam Observatory, the central bureau for astronomical telegrams at Copenhagen has been informed. Learning of the discovery by the amateur named Kutscher, Dr. R. Müller and Professor W. Münch observed the planet with a telescopic magnification of 300 diameters. Dr. Müller reported that in spite of very bad seeing a diffuse spot could be recognized in the dark northern equatorial belt, which projected to the south and to the north of the dark belt as a conspicuous arch-like formation, so that one had in all the impression of a globular object. Under more favorable conditions of seeing further details would probably stand out.

SEARCHING for the bones of extinct animals that ages ago had become bogged down in asphalt deposits at McKittrick, Calif., V. L. VanderHoof came upon a succession of layers in the asphalt, which are comparable in a way to the annual growth-rings in trees, and may have been due to the same set of causes. The yearly bands, he told members of the Geological Society of America at their meeting in Berkeley, represent a yearly recurrence of physical conditions which are influenced by climate. Winter cold so increases the viscosity of the tar that it solidifies, while high summer temperatures render it fluid and able to flow down slope. Winter rains cause enough sheet wash to blanket with dirt the previous summer flow, thus sharply marking off one year's layer from another. Mr. VanderHoof has measured and plotted a series of 180 of these bands, and efforts are now being made to correlate the resulting curves with similar curves resulting from studies of tree rings and of varves, or layers of alternating fine- and coarse-grained lake-bottom silts.

GIANT flesh-eating dinosaurs roamed the red sands of China a hundred million years ago, seeking what they might devour. At the meeting of the Geological Society of America, Professor George D. Louderback, of the University of California, told of the identification of fossil bones found in the Red Beds of Szechwan as belonging to a great reptile of the Tyrannosaurus type. This identification helps to establish the geologic ages of these deposits, which have yielded relatively few dateable fossils. Tyrannosaurus elsewhere in the world belonged to Upper Cretaceous times, which have an estimated antiquity of ninety or a hundred million years.

WHEN giant sloths inhabited Gypsum Cave in Arizona, famous for the discovery there a few years ago of human artifacts associated with the bones of extinct animals, the climate of the region probably was much moister than it is now. This is indicated by a study of the plant fragments in the digestive waste of the animals, which was abundant in the caves. A report of this study was presented before the meeting of the Geological Society of America by J. C. Laudermilk, of Claremont, Calif., and Dr. Philip A. Munz, of Pomona College. Eighty per cent. of the refuse consisted of tistues of a species of giant yucca known as the Joshua tree. The remainder was derived from various other desert plants. This yucca species does not grow in the vicinity of Gypsum Cave to-day, but is abundant in the Clark Mountains, 42 miles distant and at about 3,500 feet greater elevation, with a more generous rainfall.

EXPERIMENTS reported by G. A. Nadson and C. A. Stern, who communicated their researches to the French Academy of Sciences, indicate that metals exert a harmful influence upon microbes and seeds even though they are not in contact with them. They first found that metal plates at a distance of one to two millimeters from certain microbes influenced the microbes. Some kinds of microbes are killed, other kinds are weakened or modified in their characteristics. Metals of high atomic weight were found to be more effective than metals of low atomic weight. Thus the order of decreasing effectiveness was lead, gold, platinum, aluminum, which is also the order of decreasing atomic weight. In another investigation, a similar effect on plant life was found. Mustard seeds that had started to germinate were exposed for three days to various metal plates distant one to three millimeters, and their growth was found to be retarded. Again the influence of the metals was in the order of their atomic weights. It has not yet been determined whether the effect is due to some kind of rays, to a metallic vapor, or to other causes.