Pd and Fe are about equally hard, as we should expect. That C, B, Be, and others are hard, while Cs, Rb and P are soft is well known. We see, therefore, that hardness is quite well expressible in the same curve as melting-point.

We have, then, an interesting correlation. The spectroscopic properties and the melting-points and hardnesses are expressible in the same table. And as the agreements on the whole are so good, holding not only for metals, but for non-metals and gases, we might venture to predict the characteristics of those whose melting-points and hardnesses have not yet been determined. Thus we suggest that 85 (Eka-Iodine) will melt at about 250° C. and be fairly soft, and that 87 (Eka-Caesium) will melt at about 18° C., and be very soft. Number 93 will be hard and of high melting-point, coming as it will below Re. We also suggest that the value of Masurium, assumed in the International Critical Tables to be 2,300° C., will be nearer 2,500° C.

It is evident from the foregoing that there exists a relation between the electronic configuration and the melting-point and hardness. We notice that the atoms with the complete shells have the lowest melting-point. Those with a partial shell, such as W, Re, and Os, where about half the "d" shell is on, have high melting-points, and are hard. The "irregular" atoms, whose electron shell structure, and in particular, whose outer shell is incomplete, thus have greater mutual attraction, and less yielding to deformation of the solid configuration than those with complete shells. The deformation of a substance by shear and compression forces (the method of testing hardness) is thus quite similar in its fundamental effect on the atoms of the substance to the deformation in melting; atoms sliding on atoms more readily if the atoms have complete shells. There is evidently less stray field holding these complete shells together. Hence in the central part of each period we find the harder elements and the soft ones at the ends. This, according to our interpretation of the table, means that the elements increase in hardness as more electrons are built on, attain a maximum somewhere before half the shell is completed, and fall off in hardness as the shell nears completion to a minimum at the complete shell.

S. A. KORFF

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FURTHER EVIDENCE CONCERNING MAN'S ANTIQUITY AT FREDERICK, OKLAHOMA

IN SCIENCE of February 10 appears a note by Dr. Leslie Spier, of the University of Oklahoma, questioning certain phases of the evidence bearing on man's antiquity at Frederick, Oklahoma. The geological age of the deposits, their nature and occurrence, are well established and not questioned. He states however, "The artifacts themselves are equivocal," and questions their occurrence and contemporaneity with the fossils; and their Pleistocene age.

In relation to their authenticity as human implements, according to his own statement therein, *i.e.*, "— I have not seen the originals," he is hardly in a position to speak with authority on the matter, especially in the face of the fact that no one who *has* seen them has questioned their authenticity as human artifacts.

Dr. Spier particularly questions the grinding stones to which we have referred as "metates," in describing them. It would appear that his objection may be based on our choice of name for them, or upon a misunderstanding as to how such grinding stones were used by nomadic, non-agricultural Indians,—uses to which his published remarks would indicate a lack of familiarity. In regard to this matter, the writer has in his personal collection a number of such grinding stones from the region near the Black Hills, South Dakota, which were used by the Sioux Indians of that region when the writer first knew them as a boy. These Indians did not raise or use any sort of grain or cereal, and were a nomadic, hunting race; yet they did use, until they secured better implements and food from the white man, "metates," or grinding stones, of the type found at Frederick, Oklahoma. They used these at semi-permanent camp sites for crushing and breaking up dried fruits, (such as cherries and plums), dried meat, "Indian 'turnips,'" and other dried roots and plants which they dried and cured for winter use, much of which dried exceedingly hard.

It is entirely probable that in this, as in many other instances, need and a similar environment have caused different peoples at widely separated times and places to do similar things independently and reach similar results; and it certainly is not, in itself, and unsupported, evidence of racial homogeneity. It can equally well be, and probably is, another case of parallelism. I have personally seen these stones so used many times, and now have some of their dried foods as well as grinding implements in my private collection. Therefore, the argument that such could not have great antiquity, because, "All Americanists are agreed that cereal raising is not one of the original constituents of Indian culture" is without value. Beyond this, what "Americanist," or anyone else, for that matter, is in a position at this time to speak with authority of the habits or customs of any race

of men in early Pleistocene times in America—beyond that offered by the limited evidence of this Frederick discovery, and one or two others.

Dr. Spier's reference to determination of age by the type of artifacts characteristic of certain cultural stages in Europe is also assuming something, when applied to North America, that no one yet knows. It is well to bear in mind that the well known stages of Europe are *terminals,* and may have diverged widely from what was going on in America in Pleistocene times. Granting man's presence here, it is not safe to draw *a priori* conclusions on circumstantial inference, until they are supported by clean-cut evidence in North America. Our archeologists have studied, almost wholly, the cultures of comparatively recent times on this continent, and have not, in conjunction with geologists, (as has been done in Europe), worked out the sequence of Pleistocene events in this country, in relation to mankind. Until this is done, evidence based on type of workmanship in stone found here, is mere guesswork, outside of comparatively modern cultures. There is crying need for much to be done in this direction at this time, in America. The conviction in the minds of some men that no such evidence would ever be found in America, has, beyond doubt, gone far to retard such research.

As to the authenticity of these grinding stones, as such: Professor E. B. Renaud, internationally known archeologist, now of the University of Denver, is the last specialist who has examined these artifacts, and has just measured and examined them critically with the writer, since Dr. Spier's article appeared. He, like all others who have seen them, gives them his unqualified indorsement as human artifacts. We find all three artifacts figured in the original accounts to bear unmistakable evidence of human workmanship. The edges show distinctly the coarse chipping done in shaping them with "hammer stones" or other implements, on all sides. All three show clearly evidences of abrasion and wear *in the center on both sides.* The larger grinding stone has had the most wear, and is abraded in an oblong basin to a depth of twenty-three millimeters on one side, by about three hundred and eighty millimeters long; and eight millimeters deep on the reverse side, in a depression two hundred and seventy millimeters long. Distinct striæ from abrasion, "pecking marks," and other usual evidences of such use and wear, with which any one who knows such stones is familiar, are clear cut and abundant. There is no mistake. They are real, humanly formed artifacts, as may be observed by any one who cares to examine them, and, not merely "selected as metates because of their close resemblance to such forms."

As to their being contemporaneous with the fossil mammals of that deposit, (which Dr. O. P. Hay and the writer are describing elsewhere, in joint papers), we have rather definite, unpublished evidence to offer.

During a recent visit to Frederick, (December, 1927), the writer took occasion to examine much more carefully the upper bed in that section, (Bed C. of our published diagrams)[1] and secured evidence that we had overlooked in the early examinations. This upper bed, three to five feet in thickness, with columnar structures when dry, is composed largely of fine clays and silts, the shrinkage of which is responsible for such structure, as it dehydrates. But mingled through this bed irregularly are considerable quantities of granitic gravels, some very coarse. Being situated on a hilltop, it is obvious that this gravel must have been washed there from higher levels before it *was* a hilltop, and while the surrounding surface levels were at least as high or higher than this hill is to-day. As the hill is about one hundred feet above local valleys, and in the light of correlated evidence on this erosion, previously published, it becomes obvious and certain that Bed C, as well as the underlying cross-bedded sands and gravels, is of Pleistocene age. Only in its very surface, and a few inches down, are recent deposits possible, save by intrusive burial of some sort. Now, Bed C is very dark red in color, heavily permeated with stains of hematite, so that all included gravels and anything it may contain are stained a deep, muddy red, so dark that even photographs of the deposit sharply outline it from the underlying Bed B. Obviously any implement which came from these surface deposits, or any such wash-filled basin as Dr. Spier imagines as possible or even from any stage of the Pleistocene Bed C, would certainly bear unmistakable evidence of its origin from this stain.

Re-examining with this in mind, with Dr. Renaud, we note that these grinding stones are *not* so stained, but bear only a slight, much lighter colored stain, such as characterizes Beds A and B in local lenses. Beyond this, in the rough surfaces of the stone, and adhering to their surfaces in many places, are still many areas of matrix, still cemented to the stones and unmistakably undisturbed, as found by Mr. Holloman. This matrix is that most characteristic of Bed B, but also occurs in the upper part of Bed A, where Mr. Holloman reported finding the implements; and, by no chance could it pertain to a level as high as Bed C.

I believe that no further authentication of the accuracy of Mr. Holloman's statement as to their

[1] *Natural History,* Vol. XXVII, No. 3, 1927.

actual occurrence in these Pleistocene beds is necessary. Mr. Holloman is now keenly alive to the importance of these discoveries, as he was not when we first talked to him; and, as he had previously found and discarded other similar implements before we saw him, he is confident of eventually finding more, as commercial quarrying continues in this deposit. When it is found, he told the writer that he would do all in his power to protect it *in situ*, and wire for authorities to come and view it for themselves. Consequently, as the quarry is now being actively developed, further discoveries are to be expected in this great deposit.

HAROLD J. COOK

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THE GEOLOGY OF SONORA

WHILE making a study of the sedimentary rocks in the Cananea Mining District, Cananea, Sonora, Mexico, I found some fossils which Dr. G. H. Girty, of the U. S. Geological Survey, has determined as belonging to the Carboniferous Age. The limestone in which the fossils occur was formerly considered to be Cambrian.[1]

Dr. Girty says: "The fossils from Cananea accompanying the letter of February 19 from Dr. Graham John Mitchell are, without much question, of Carboniferous Age, but to assign them within the Carboniferous System with any degree of certainty is impossible. The specimens, all very fragmentary, include cup corals (*Triplophyllum*? and *Lithostrotion*?), a strophomenoid (*Schuchertella* or *Derbya*), a *Spirifer* (apparently of the *Rockymontanus* group), and *Hustedia*."

GRAHAM JOHN MITCHELL

THREATENED EXTINCTION OF THE RUFFED GROUSE

ACCORDING to a recent report of the Department of Fisheries and Game, the ruffed grouse is facing extinction in the state of Massachusetts. Only a few of these magnificent upland game birds have been seen within the past year; and why this is so is not fully known, though it is believed that they have succumbed to a periodic visit of the partridge sickness. The winter and spring of 1926–27 were not sufficiently severe so as to decimate any large numbers of them, nor was the toll of the hunting season unusually large. But with the present mild winter, and a good breeding season, it is hoped that this once common game bird will be able to make sufficient numbers to withstand successfully the depredations of its natural enemies during the coming year. And with a closed season next fall, which the legislature is at present considering, to assist in their fight, it is believed that within a year or two they will be back on a fairly sound basis. It is to be regretted should this bird have to be added to the already long list of vanishing species.

[1] *Ec. Geology*, vol. 5, No. 4, June, 1910, page 317.

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WHAT IS A NAME?

SINCE Dr. Holland's recent fatherly note (SCIENCE, Feb. 10, p. 161) the differences between us seem reduced to one (I will not quarrel over the word "binomial"):

Is Limnas ferruginea Chrysippus (Hübner) as good a name as Papilio Danaus Festivus Chrysippus (Linnaeus) or Sphinx Adscita Phegea, which every one accepts?

The idea will be expanded in *Entomological News*.

WM. T. M. FORBES

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SCIENTIFIC BOOKS

A treatise on the British Freshwater Algae in which are included all the pigmented Protophyta hitherto found in British freshwaters, by the late G. S. West, M. A., D.Sc., F. L. S., A. R. C. S., professor of botany at the University of Birmingham. New and Revised Edition in great part rewritten by F. E. FRITSCH, Professor of Botany in the University of London. (Cambridge, The University Press) xviii+ 534 pp., 207 figs. in text. Price 21 shillings. 1927.

THE first edition of this highly valued treatise, issued nearly twenty-five years ago, has been so long out of print that this new and up-to-date edition will be doubly welcome. Since the microscopic freshwater flora is so cosmopolitan in its distribution this handbook will serve others than British investigators. It will also be useful to zoologists as well as to botanists, since the reviser has included all pigmented or colored flagellates within the Algae. The first fifty pages are given to generalities, such as the ecology, distribution, collection, cultivation, structure, cytology and reproductive processes of the Algae. The author is inclined to minimize the significance of the polymorphism of the unicellular Algae brought about in cultures because of the lack of correlation of such results with the same species in their natural environments. Certain normal well established instances of polymorphic life cycles of both unicellular and multicellular stages do not justify sweeping general conclusions at present as to the extent of comparable polymorphism elsewhere among the Algae.