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Recent developments at the laboratories of the United States Geological Survey have led to the development of obsidian dating, a method which holds promise for both geology and archaeology.

The process, pioneered and developed to its present state by Irving Friedman, C. S. Ross, and Robert L. Smith, is far from a functional dating scheme, but shows promise of producing a wide-range system that will help bridge the gap between radiocarbon dating and the potassium-argon method, as well as augmenting radiocarbon dating within the range of that method.

In essence, the method of obsidian dating depends upon the adsorption of water by a freshly exposed obsidian surface. As the water is adsorbed, it diffuses into the interior of the obsidian. This diffusion process results in a zone, parallel to the surface, of hydrated material which optically of different density from the non-hydrated obsidian. This layer is readily examinable under a microscope. The depth of the layer thus formed is dependent upon time, temperature, chemistry of the obsidian, and perhaps upon the chemistry of the surrounding soil. It does not depend appreciably upon the humidity of the environment.

Preliminary work has shown that the chemistry of the obsidian can probably be simplified to the dichotomaic classification of the obsidian as either trachytic or rhyolitic. While more work needs to be done on this problem before a definite statement can be made, it has been shown that rhyolitic obsidian from various parts of the world appears to differ little in its hydration rate if other quantities are equal.

The influence of soil chemistry is relatively unexplored, but it seems likely that this factor, too, is small in most cases. Further work needs to be done on the subject, before dating can be accomplished with reliability.

Temperature would be expected from diffusion theory to be an important factor in the rate of diffusion of the hydrated layer, and this has proven to be the case. This will probably be far more important than any other variable in the process. Friedman and Smith have checked a large number of obsidian samples from archaeological horizons whose age had been deduced from other considerations. They sought to devise temperature tables for Arctic, Temperate, and Tropical zones. Using these tables, they dated other specimens to compare with their estimated archaeological dates. The results were fair in most cases.

In fairness to the method, it should be pointed out that some of the dates they sought to compare with were very poorly established, such as the Denbigh Flint Complex in Alaska, and hence could offer little by way of a test of the method. Comparison with carbon dates, or at least better established dates, will have to be done to thoroughly test the process.

In future testing, it seems that one of the basic problems will be that of temperature. Rather than assign broad zones to the temperature classes, it would seem to your editor that it should be the responsibility of the archaeologist to furnish a reasonable annual temperature average for the soil layer in which an artifact is found. If temperatures are furnished for all the layers above the one in which the artifact is found, it may be possible to calculate a reasonable temperature history for the site, or for the artifact in question. When the influence of temperature is more accurately known, an age calculation could probably be rendered more accurate by taking into account its entire temperature history.

One of the principal sources of error in obsidian dating, and one which it seems may be impossible to entirely eliminate, is that of surface exposure to the sun. An obsidian artifact lying on the surface in direct sunlight for a few years may have its hydration zone deepened a great deal more than one lying beneath the surface in the same area. Obsidian is usually and dark and translucent, so that it may absorb a great deal of radiant energy and become quite hot while in the sun. This higher temperature leads to a faster diffusion rate than for cooler materials lying beneath the surface. Some attempt to offset this effect can possibly be made by averaging the temperature of a sample of obsidian lying on the surface. While this does not provide any evidence of the length of time the sample has been on the surface before being covered, it will perhaps provide an estimate of the error introduced. It may be that radiational cooling during the night may offset the daytime absorption to some extent. It is hoped that your editor can report something definite on this in the near future.

The future lines of research in the field of obsidian dating would seem to focus along three lines: (1) The measurement of samples of known age from environs of known average temperature. (2) The measurement of samples of different chemical composition from similar environments, to test the effect of artifact composition. (3) The measurement of samples of known age from soils of different composition in order to determine the effect of the cheimical environment upon the resulting date.

Other sources of error in the method are: (1) Abrasion of the surface by wind- or water-born abrasives. (2) The re-use of artifacts from an earlier culture. (3) The use of natural obsidian with some of the natural surface retained in the finished artifact. The possibility of the first error is uaually eliminable by inspection. Abrasion leaves tell-tale pits and striations on the surface which can readily be seen under the microscope.

The re-use of an artifact without any modification would be impossible to detect, but if some rechipping, either by intent or through usage, occured, the error could be eliminated by testing several portions of the surface. The same procedure would apply in the case of an artifact with a natural surface. It would be the province of the archaeologist to determine the significance of the various dates obtained from various parts of the surface. It should be borne in mind that the method actually dates the surface of the artifact at the point from which the sample is taken.

Your editor has designed an electronic thermometer with which to measure the surface temperatures of small objects and also the soil temperatures at various depths in a site. The sensing element is very small and can be placed at any distance from the reading meter. A very small hole would suffice to introduce the element into the ground to measure subsurface temperatures in a site before the ground is disturbed. Since the sensing element is a tiny thermistor, it could be used to make temperature measurements on an obsidian flake without disturbing its thermal equilibrium. Readings are produced very quickly.

The Wyoming Archaeological Society will set up an obsidian dating experimental station in the immediate future. The equipment is simple and relatively inexpensive, and much valuable research can be done in such a laboratory.

The treatment of the sample consists of using a thin (.015 inch) diamond saw to remove a piece of the material to be dated. The cut is made at right ngles to the surface. A second cut is made to remove the piece. Usually, the two cuts are made in such a way as to remove a small wedge of the material. The first cut surface is cemented to a dop stick and the other surface ground down on a steel lap until a thickness of 1/32 inch is reached. The specimen is then cemented to a glass slide and ground to a final thickness of about .01 inches. A cover glass is then cemented over the specimen and it is ready for examination and measurement under the microscope. With experience, the authors claim, three specimens an hour can be mounted.

The first complete summary and evaluation of the obsidian method was published in AMERICAN ANTIQUITY, volume 25, number 4, for April, 1960, in an article by Friedman and Smith.

SUPER ARCHAEOLOGY?

As in any other discipline, progress in archaeology has brought problems. Among the most outstanding are: (1) the growing mass of information which must be disseminated; (2) the advent of technical methods from other disciplines which are highly desirable, but often expensive or hard to obtain; (3) increasing need for speed in handling salvage and other types of archaeological field work.

Among the fundamental problems besetting all scientific endeavor in recent times is that of communication. Vast amounts of information are being recovered, and it is very difficult for a researcher to keep abreast of all the latest discoveries and developments. Not the least part of the problem is that there exist large numbers of journals in each field which may carry these results. Tl make matters even worse, there are many instances in chich archaeological results are published in journals entirely outside the archaeological field. An archaeologist would have to subscribe to several dozen periodicals, a clipping service, and maintain a barn-sized library, to keep in touch with his entire field.

The Society for American Archaeology has taken what seems to be a long step forward in the field of communications in archaeology. It is currently testing a micro-card system for the circulation of articles on archaeology. In this system, pages of manuscript, maps, drawings and photographs can be photographed onto a three inch by five inch card. About 40 pages can be put on each side of the card. A 30 volume set of books can be stored in an inch of file space. The method is very versatile and inexpensive.

Every article now published on archaeology in a year's time could easily be placed on a handful of cards. It would be a tremendous step forward if such a central system could be established, and all the minor journals in the field (such as this one) be abandoned and their funds contributed to the central distribution center. In this way, complete and uniform coverage would be available at reasonable cost to every person interested in the subject. The method is so inexpensive that even relatively common reports could be published in detail.

The second problem mentioned, that of the desirable, but often unobtainable, technical augmentative study, is somewhat more difficult to solve. For each archaeologist to have available all the technical help that he could profitably use seems to be an unattainable goal. However, a great step in the right direction could be made by constructing a central laboratory serving only archaeologists. The facilities could include such esoteric things as radiocarbon dating, obsidian dating, palynological laboratory, thermoluminescent dating, dendrochronology, paleontological laboratory, paleobotanical laboratory, and a host of other disciplines. The sole function of the laboratory would be to serve the field of archaeology. In addition to furnishing routine services in the given fields, research on new methods might be undertaken.

It can be argued that most of these services are present in a large university. However, it should be pointed out that these services are part of some branch of the system which has its own problems and research to take care of. Their services are available to the archaeologist only if the department's own needs have been met. Often there are long and taxing delays. Frequently, the specialist in another field is not aware of quite what the archaeologist wants, and this leads to delays and misunderstandings.

A central institution devoted entirely to archaeological problems might be an answer to many of these problems. It could draw its personnel from universities and colleges. The institute could offer credit courses in its specialized disciplines, and could offer facilities for original research in certain pertinent areas. By cooperative arrangement with the schools from which it draws its personnel, it could furnish credit for much of the work done. Such a central facility would eliminate some duplication now extant, and would offer opportunities for schools that now offer nothing in such specialized fields. The service would be accurate and directed to the archaeologist's special problems.

The third problem mentioned above, that of more efficient field methods, is something that could possibly be improved with a little effort and not too much expense. Little actual effort seems to have been directed to this problem. Most of the time consumption in field work is involved with the handling of dirt. The necessity for careful work often results in tedious methods that are almost painfully slow, ven where slowness is penalizing, such as in salvage work.

With the expansion of dam and highway systems in this country and others, speedi is often essential. The careful work that is basic to the recovery of archaeological information is not necessarily diametrically opposed to speed, we believe. A search for tools with the dirt-moving ability of a bulldozer and the finesse of a camel's hair brush may not be entirely born of poppy-smoke.

In a few cases, archaeologists have been able to avail themselves of heavy machinery for removing sterile overburden or for backfilling excavations, but few crews have such equipment as part of their equipment. Such machinery is expensive and there is too much work that it cannot do in an archaeological site.

In a typical operation, dirt is trowelled from the working surface into a small heap in the working area. This in turn is hand shovelled into a screen for precautionary sifting. The sifted dirt is then removed to a dead area for storage until it is to be returned to the excavation. Several operations are involved with the same dirt. Most of the operations are performed by methods that might well have been used five thousand years ago. We will omit reference to the shadoof used at Magic Mountain last year.

The use of small fresnos or slips to be pulled by a Jeep or other vehicle is one clearly indicated course of action. Such devices are very inexpensive, and trial shows them to be vastly superior to a hand-operated shovel for moving dirt. A small fresno is easily controlled and can be used to strip off dirt in one-inch layers when desirable.

Electric power plants for powering lights and other equipment are invaluable in site work. In many cases, good lighting will enable the workers to work at night when temperatures are more moderate, or to work twenty four hours in shifts. Such power plants can often be obtained from surplus outlets at reasonable cost.

The Wyoming Archaeological Society is currently working on the problem of mechanized operation at the work face in productive soil. By the end of the summer, it hopes to have built a vacuum-line apparatus for the removal of soil rapidly and efficiently. The basic idea is described below.

Many ideas could be contrived if a little attention is given to the matter. Some may prove quite workable. Others may have to be discarded. The point is that some thinking should be done on the subject. It should not be taken for granted that the methods of our ancestors are still adequate or impossible of improvement.

With technological advances available in many fields, let's try to make use of them in meeting the three problems outlined above. Let's not be afraid to daydream a little about our problems and perhaps we can improve our efficiency and do more productive work in a given time.

MECHANIZED ARCHAEOLOGY

Among the gadgets that the Wyoming Archaeological Society hopes to have built before the summer is over is a vacuum line excavating tool. The apparatus is intended to move large volumes of dirt with speed and care.

In principle, the device is just a large vacuum cleaner. The intake hose is equipped with a screen in order to prevent the ingestion of small artifacts. The screen can be removed when it is desired to remove small pebbles from the work area. The intake hose can be made as long as desirable, and the dirt is discharged at the dead area. The intake is equipped with detachable scrapers and blades to loosen hard dirt.

The output end of the system can be variously designed. In open areas, the dirt can perhaps just be blown into a refuse heap. If dist is a problem, then a large oil drum can be converted into a self-dumping catch-bin. Dust problems at the working area can be brought to a minimum. The apparatus, if it proves practical, should speed up dirt handling by cuttin down the number of times the dirt is handled. The intake scrapers will take the place of trowels. The intake screen will take the place of the hand-operated screen, and will leave the artifacts essentially in situ. The hose and dumping system will eliminate much shovelling and wheelbarrowing of dirt. The worker will always have a clean working area, and he can control the gentleness of the operation by varying the proximity of the intake nozzle to the workface. Anything from a small tornado to a gentle zephyr can be utilized.

If trial proves such gadgetry practical, plans will be made available to those requesting them. Perhaps the idea won't work. Perhaps its usefulness will be limited to certain types of working conditions. In any case we think it's worth a try, and if we don't try, we'll never know.

OVER THE CAMPFIRE

On July 15th, operations will begin at the 48 JO 301 site again. It is hoped that the site, which yielded so much information last year, may be carried to its planned conclusion this summer. It is also hoped that further work at the 48 JO 303 site and some others in the area may be carried forward.

Dr. Glenn Jepsen furnished some valuable reference material on antiquities laws in the various states which will help draft improved laws for our state. We have been lookinf for just such information for some time. Dr. Jepsen also contributed ten dollars to the William Mulloy Memorial Scholarship Fund.

Dr. Agogino was recently honored by a doctor's degree from the Rome Academy of Arts and Sciences. He is reported to be the third person in America to be so honored.

The memoir is going to press. This is your last chance to notify the secretary of your chapter, or the state secretary, if you want to reserve a copy. Only as many copies as needed will be ordered.

EMBERS OUT