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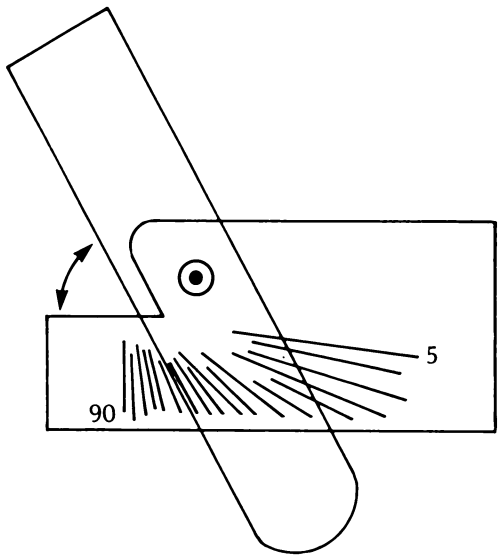

Fig. 1. This is an illustration of a plastic measuring device designed by R. L. Bettinger to measure edge angles on artifacts. Angles are measured at 5^{o} intervals from 5^{o} to 90^{o}. The device is somewhat like a goniometer, but the cut out side makes measurements both easier and more accurate. The swinging arm is painted white to facilitate reading on the scale. The drawing is approximate.

RESEARCH REPORTS

A SPECIALIZED OBSIDIAN QUARRY AT OTUMBA, MEXICO: IMPLICATIONS FOR THE STUDY OF MESOAMERICAN OBSIDIAN TECHNOLOGY AND TRADE

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This paper describes a visit to the Otumba quarry on March 18, 1979, with a group of archaeological students from the Mexican National University. The purpose of the trip was to teach the students about the local ecology (taught by Laurc Gonzales) and about obsidian technology (taught by Gian Franco). Specific observations detailed below result from the didactic atmosphere that prevailed during the excursion as well as from several presentations of knapping techniques using

Otumba obsidian. Although the Otumba or Teotihuacan obsidian source has been reported previously (Spence & Parsons 1972), additional observations are desccribed. The Otumba quarry is compared to other Mesoamerican obsidian sources and found to be unique. The implication of quarry specialization as it concerns Mesoamerican obsidian trade is then briefly discussed.

OTUMBA QUARRY

The Otumba obsidian quarry is very different from the Pachuca, Hidalgo, Mexico, and El Chayal, Guatemala, quarries. Production at Otumba seems to have focused on the manufacture of large bifaces or projectile points (Spence & Parsons 1972: 23), including arrowheads. This contrasts to the emphasis on blade production at Pachuca, Zinapecuaro (Mexican), El Chayal, San Martin Jilotepeque, and Ixtepeque (Guatemalan) (Spence & Parsons 1967, 1972; Breton 1902; Sidrys et. al. 1976; Michels 1975; Sheets 1975; Holmes 1900, 1919; Clark n.d.; Charlton 1969; Graham & Heizer 1968). Numerous large flakes, blanks, preforms, and rejected biface fragments representing all stages of biface manufacture were observed. Several nearly finished bifaces and arrowheads were also seen. Many of them displayed end shock and were probably discarded for this reason. Other obsidian debris included lipped bifacial thinning flakes and other flakes of all sizes. The characteristics of the debris were at first surprising since they contrast with that from blade (core-preforming) industries known from other Mesoamerican quarries. For this reason, a concerted effort was made to find evidence of such an industry, but only two small, poorly-shaped blade cores and several fortuitous percussion blades were found. This observation concurs with that of Spence & Parsons (1972:23).

This apparent specialization in the manufacture of bifaces and related products rather than prismatic blades may be due to the raw material itself. Most of the nodules are tabular or "amorphous" in form and cannot be easily manufactured into polyhedral cores. The author was asked to demonstrate a blade-making technique for the students and had difficulty in finding a nodule that would be suitable.

In addition, none of the naturally-occurring volcanic rocks associated with the obsidian deposit were suitable for hammerstones. Only three hammerstones were found at the workshop; these were discoidal in shape and obviously of imported stone. The best example was a broken mano which had been reused as a hammerstone.

Obsidian can be seen *in situ* in a vein of badly fractured pieces and on the surface as the residual product of erosion. Two distinct colors of obsidian are present. One is the opaque, banded gray and the other a cinnabar-red and mottled black, or "meca" obsidian. The "meca" obsidian is plentiful and occurs in large pieces, as does the opaque, banded gray. However, the majority of the obsidian is gray. Bifaces of both colors were found.

The obsidian is rather homogeneous and of good, but not superior, quality. During the demonstration, the author found it quite difficult to remove the cortex. (This may have been because of his unfamiliarity with the obsidian and the lack of a good hammerstone). The Otumba obsidian is harder to work than that from the Pachuca source and has a grainer texure. Tools made from this obsidian would be "tougher" (in the same sense that chert and flint are tougher than obsidian) than those from the Pachuca obsidian, but less sharp. This quality may have been particularly desirable for projectile points and scrapers.

QUARRY SPECIALIZATION

Spence & Parsons have reported on the quarries at the Pachuca source and Otumba or T.A. 79 (1967, 1972). They also note the emphasis on biface manufacture but add end scrapers as well (1972: 23). They describe five pressure-blade cores from Otumba and two from which percussion blades had been removed. Comparing this source to that at Pachuca (Cerro del Milagro), they convincingly show the complementary specializations of both. That these quarries were indeed specialized can readily be discerned in the distribution of artifacts in the surrounding area. Spence & Parsons report the presence of gray obsidian in workshop debris found near the Pachuca source; most of these were projectile points (1972:13,18). Inversely, Pachuca or green obsidian blades were found in workshop debris a short distance away from the Otumba source and workshop (1972: 22). What is known of the sites in the surrounding area substantiates this pattern.

Spence has noted the relationship between green and gray obsidian at Teotihuacan. In the early period, the majority of the obsidian used was gray - most probably from the nearby Otumba source. This clearly reflects the exploitation of the local resource. However, beginning with the Miccaotli phase, green obsidian (Pachuca) was used almost exclusively for the production of prismatic blades, while the majority of the projectile points and scrapers continued to be made from gray (Otumba) obsidian (Spence 1967:510). This pattern continued into the Colonial period (Cressey 1975a, 1975b), and has also been noted at Tula, Hidalgo (Benfer 1974: 60, 86). As Spence & Parsons point out, this indicates that the quarries were complementary and were probably under the same political control (1972).

The Pachuca/Otumba example is an obvious case of radically different specialization between potentially competing quarries. Examination of the San Martin Jilotepeque, Guatemala source indicated that it, also, was different from that at El Chayal; different cores were exported from the two sources (Clark n.d.). Technique may also be a part of quarry specialization. Even though bifaces were manufactured at both the Pachuca and Otumba sources, the reduction sequences were different. At Pachuca, the bifaces were made on macroblades; at Otumba, they were core tools or made from large flakes.

Specialization, however, can be intra-quarry as well as inter-quarry. There is evidence that individual obsidian sources and quarries were internally differentiated. Holmes found little or no evidence of biface manufacture at Pachuca (1900), whereas Spence & Parsons located several workshops which seem to have specialized in biface production (1972: 19). Charlton suggests that they visited different loci of the same source (1969). This implies intra-quarry specialization. Specialization of different workshops within one quarry may also be characteristic of Guatemalan quarries. Coe and Flannery reported numerous biface and retouched tools at El Chayal (1964). Michels, however, could not find any and concluded that the quarry was restricted to the manufacture of cores to be exported (1975: 104). A similar search in a different workshop of the same source (La Joya) also failed to produce any bifaces (Clark n.d.). It may be that Coe and Flannery located a specialized workshop in the El Chayal quarry which has not been reported since. All these examples are evidence for either quarry specialization or internal differentiation among the workshops at one source. A systematic study of obsidian quarries in Mesoamerica will hopefully delimit the variation among and within quarries and workshops.

CONCLUSIONS

The meager information presently known about the obsidian quarries in Mesoamerica suggests that different quarries or the various workshops of one quarry may have been specialized. The most notable and well-known dichotomy is that of the Pachuca and Otumba sources. The fact that quarry specialization is known to exist has important ramifications for the study of Mesoamerican obsidian trade. At the very least, it should indicate that technological studies should be concomitant with the study of obsidian sources. In this manner, special or subtle techniques may be demonstrated to be source or quarry specific. For example, Benfer mentions that all of the green prismatic blades at Tula have abraded platform surfaces, while the gray and black blades have a different platform preparation (1974: 75). Future detailed studies on a par with that of Benfer may reveal other minor differences. Furthermore, during the Late Preclassic period, tanged macroblades or "daggers" were imported into many sites in the southern Mesoamerican area (see Coe 1957 for early references; Lee 1969; Clark & Lee 1979). They are known to come from the El Chayal source of Highland Guatemala (unpublished data). It will be interesting to determine whether or not they were manufactured exclusively at this source or at others as well.

Too often, studies of Mesoamerican obsidian trade focus on the source of obsidian and pay little attention to artifact types or their technological features. If such studies (technological and source analysis) were undertaken jointly, it would then be possible to determine the spatial distribution of the various techniques in Mesoamerica. Given thoughtfully selected obsidian pieces from dated contexts, such a study would have temporal depth. When the spatial and temporal coordinates for different manufacturing techniques have been determined, one may then be able to infer the sociopolitical influences which caused the observed patterns. Specifically, these temporal-spatial patterns may aid in understanding the political control and regulation of obsidian quarries. The Pachuca-Otumba dichotomy demonstrated that socio-political information can be inferred once contemporary inter-regional quarry specialization is shown to be complementary.

In summary, concomitant study of obsidian technology and sources can reveal significant information about trade routes, products, craft specilization and the socio-political organization of the source area. Future studies may show that each quarry was organized to produce one or more products, a distinction perhaps being made between products for local and long-distance exchange. Such studies could be performed with artifacts recovered from habitation sites, but should also be approached from a quarry perspective. Study of Mesoamerican obsidian quarries is badly needed, especially of the western Mexican, Veracruz, and Puebla sources.

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A LITHIC LAB AID

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Recently I visited the office of a dermatologist friend and spied a gadget which seemed applicable to lithic analysis lab work we were doing. Figure 1 is a natural size blackline reproduction of the "B. W. Co. Measure", a copyrighted heavy plastic measuring guide, used to measure skin lesions. I saw it as a possible means for providing an advance over the lithic flake size measuring techniques we were currently using in the Texas Tech lab.

Beginning with the lab stages of the 1974 Guadalupe Mountains National Park survey, and in several subsequent projects, Paul and Susanna Katz and I have experimented with several different kinds of means for quantifying (and qualifying) chipped flake sorting operations. In general, chipped materials have been sorted into size classes by matching them to circles of various diameters. This quantified sorting has been done in a variety of ways, depending upon problem and research design requirements. It has been most helpful in providing rapidly obtainable quantitative data intermediate between individual specimen measurements and gross typological size classes.

When maximum flake dimension is desired, the "B. W. Co. Measure" has proved to be a handy device for rapid individual sorting. It is, of course, scaled in full centimeter intervals and has a maximum range of 7.0 cm. The concentric principle, however, can be used to create a device with greater range and/or more sensitivity.

This measure is not for sale, but limited quantities are available free-of-charge upon request. The latest edition of the measure is identified by the number N-107. Requests should be sent to: Elmer Schorzman, Assistant Advertising Manager, Burroughs Wellcome Company, 303 Cornwallis Road, Research Triangle Park, N.C. 27709 U.S.A.

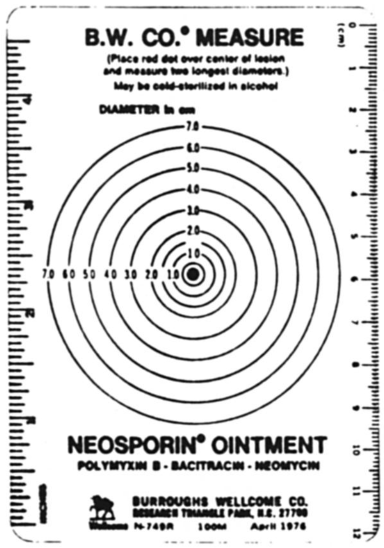

Fig. 1. B. W. Measure (black and red print on plastic sheet).