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Sources of Maya and Central American Jadeitites

Data Bases and Interpretations— A Summary

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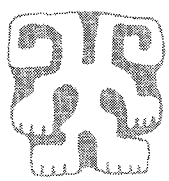
The preceding chapters presented analytical data concerning the nature of mineralogical and chemical variation in jadeitite and jadeitic artifacts, as well as documentation of the wide variety of raw materials used in the prehistoric lapidary arts of Mesoamerica and Central America. The central issues surrounding the number and location of the source or sources for many of the carved artifacts remain unresolved, however. One view, the single-source hypothesis, is based upon mineralogical observation and plate tectonic theory. Harlow argues for the existence of a single source located in the Motagua Valley of Guatemala. According to him, this source supplied the raw material for all of the jadeitic artifacts, whether encountered in central Mexico, the Maya region, or lower Central America. An opposing view, treated here as the multiple-source hypothesis, combines chemical data with structural characterization and infers that the observed differences among compositional and structural groups of jadeitite source materials and artifacts are sufficient to reject the notion that a single source located in the Motagua Valley supplied the procurement needs of the precolumbian inhabitants. Hauff's mineralogical research also tends to refute the single-source theory.

The opposing views concerning the source of precolumbian jadeitite have been formed from the two different data bases. A third data base, consisting of archaeological distributional evidence, also exists. Although not explicitly presented, it was implicitly used to guide the modeling of the compositional data obtained by INAA.

In this summary we review the two geological and chemical data bases in an attempt to reach, from the archaeological data presented in Parts II and III, a "best fit" between the different kinds of information.

In Chapter 1, Harlow noted the geological constraints that restrict the formation of jadeite-rich rocks, or jadeitites. They occur in only a few places in the world because they are a product of limited conditions. Jadeitites are interpreted as having been formed chemically from preexisting rock or from



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fluid transport of the components of preexisting rock. Although the range of rock components may be large, it is viewed as sufficiently limited so that the jadeitite rock suite may have a "signature" that is mineralogically circumscribed. The occurrence of the known jadeite sources and associated serpentinites is observed to be correlated with faults that tend to be large, active, horizontal in movement, and occur in relatively young geologic environments. Accordingly, Harlow posits a "generic" relationship between plate tectonics, jadeitite formation, and how the area of formation would appear on the surface. From this, he argues that one can use geologic maps showing tectonic features to infer those regions where the formation of jadeite would be likely to occur. The Motagua Valley is one area where the conditions that he sets forth are met; the jadeite rock recovered from the valley, the Motagua-I source material, is found to be "totally consistent" with the proposed associational model.

Mineralogical heterogeneity within the Motagua source materials or within the jadeitic artifacts reflects the diverse suite of rock that can make up the jadeitites. Harlow describes a suite of minerals that is characteristic within that potentially diverse array of the Motagua jadeitites, however: jadeite, albite, white mica, K-mica, and titanite (sphene).

Color variation, Harlow finds, can also be accommodated within the Motagua region. Emerald green could result from the mixing of chromium-containing chromite into jadeite within a serpentinite environment. Darker varieties of jade appear as a function of varying amounts of chromium omphacite, and even blue green "Olmec" could be accommodated within the potential range of mineralogical or chemical mixing.

Harlow perceives jadeite occurrence through a model based on experimental findings that produce synthetic jadeite and through interpretation of jadeite formation processes and linkage to tectonic conditions and mineralogical associations (e.g., serpentinite). From this he defines a range of expectable variation in the jadeitites that is sufficiently broad to encompass known occurrences, including the relatively unstudied Costa Rican area. Inference appears to be used to support inference.

Negative evidence also is used to support the single-source model. Puebla or Chiapas, Mexico, or northwestern Costa Rica are frequently mentioned, based upon our knowledge of artifact recovery, sales to tourists, or presence of serpentine rocks, as areas of possible jadeite occurrence. As Harlow points out, although these are areas of "minor" serpentinites, they have failed to yield demonstrable occurrences of jadeite. They also lack the requisite active lateral faults or rock assemblages indicating a necessary level of metamorphism and are outside of conditions required by Harlow's model.

Bishop and his colleagues (Bishop et al. 1985; Chapter 2) approach the question of the precolumbian jadeite exploitation predominantly through the use of chemical data derived by INAA. The chemical data are supplemented by more-limited use of structural analysis by X-ray diffraction. Like Harlow, Bishop and his colleagues regard the "jade" source and artifactual material as a potentially heterogeneous assemblage. Their use of the chemical data is empirical in that they visually and mathematically inspect the data set for "clusters" of data points that are more similar to one another than to other clusters. Observed in the chemical data set are patterns of relative homogeneity that, when informed by the structural analysis, are found to covary with mineralogical assemblages or regularities in X-ray peak shifts.

Curtiss and Hauff also address the problem of variability in jadeite materials from the perspective of visible and near-infrared spectroscopy, X-ray diffraction, and petrographic analyses. Hauff's research in particular is designed to test the single- and multiple-source alternatives.

In all cases the focus of the compositional investigation is on source specimens and artifacts containing jadeite as a predominant mineral or, to a lesser extent, containing albitites. Although relatively large numbers of minerals are potentially present, within the resolution of the X-ray analysis, and as verified through supplemental petrographic examination, the observed mineralogical assemblages are more limited. For the Motagua source specimens and the artifacts attributed to that source region, the minerals present are in full agreement with the description given by Harlow. Several of the formed compositional groups are constituted in part by source specimens; others have chemical and mineralogical characteristics that are sufficiently similar to groups consisting of Motagua source materials to suggest the Motagua Valley as their probable source.

As Harlow notes, major interpretative problems reside with the chemically derived groups of specimens labeled as Maya Green and with the compositional units whose provenience lies in Costa Rica. On the basis of the compositional data alone, it would be difficult—if not impossible—to conclusively demonstrate that these "divergent" reference groups did derive from the Motagua source area. In the absence of characterization of distinct sources in the Motagua Valley other than in the same general region sampled by Harlow, Olds, Bishop, Hammond, and others, investigators cannot bound the observed chemical variation that might serve to differentiate among different sources. Indirectly, the similarity evidenced among the compositional groups containing Motagua region source specimens in combination with groups that have jadeitic or albititic artifacts from sites within the Motagua Valley has been used to infer reasonable limits upon the chemical variation that is likely to be encountered in the valley. Therefore jadeitites and, to a much lesser degree, the albitites of the Motagua Valley are characterized empirically. The less sophisticated, but nevertheless important, distributional studies reported by Ruenes and Soto demonstrate the range of nonjade materials being used in the Costa Rican lapidary tradition.

As with Harlow's observation, Bishop and Lange recognize that new areas of jadeitites, including specimens whose composition might match the Maya Green group, might eventually be found in the Motagua Valley. Unlike

Harlow, they consider the possibility of finding source materials similar to the Costa Rican groups to be more unlikely. The difference is between "lumpers" (a single source) and "splitters" (multiple sources), who view the same data base from widely divergent perspectives. Anthropologically, these differing views not only reflect alternative interpretations of the data base, but also differing perceptions of the nature of human behavior and technological production.

The multiple-source proposition derives in part from observation of trace elemental systems in a range of materials (glass, pottery, metal, and rock) analyzed—modeled—within the archaeological context. The chemical compositional analysis of jadeite-containing rocks results in weighted elemental expressions of all constituent minerals or of the deposition of fluids that were derived from a conceptually diverse range of minerals. This potential heterogeneity is correctly identified by Harlow as one that is difficult to interpret on the basis of the chemistry alone. Because of the potential mineralogical and chemical heterogeneity, and in keeping with his model of a genetic relationship between plate tectonics and jadeite formation, Harlow finds only a single region suitable as the source of Maya, Costa Rican, and even Olmec jade artifacts. Nevertheless, within the potentially wide range of minerals and conditions that might lead to jadeite formation, he is able to derive a suite of minerals that constitutes a mineralogical signature for the jadeitites of the Motagua Valley. In other words, within a vast range of possibilities the observational manifestations are more limited and therefore permit the characterization of the jadeitites of the region.

If the chemical analysis of jadeite-containing materials were carried out in isolation from other kinds of information, interpretation of specimen-to-specimen similarity or the extent of "natural clusters" in the data set would be difficult. The numerical modeling of the structure or structures contained within a compositional data set has been discussed in detail as it pertains to multiple-component ceramic materials (Bishop and Neff 1989). The choice of data transformation, algorithmic approach, identification of "outliers" relative to a group, use of interelemental correlational characteristics, and so on are all relevant—and all must be evaluated within a specific problem formulation. That problem formulation is predicated upon both theoretical and informational contexts. As it would be difficult to interpret observed chemical variation in the absence of mineralogical data, compositional data—chemical or mineralogical—on ancient mineral procurement sources are limited in the absence of archaeological information. Some logical circularity obviously is built into this contextual interpretation of compositional data; that is, archaeological distributional or stylistic data are used to guide the interpretation of the compositional data, which are then used to make archaeological inferences. Nevertheless, this type of investigation explicitly recognizes that a body of archaeological information exists and represents a data base that is supplemental to the compositional data bases.

In this summary we focus on only those aspects of the archaeological record that treat the gap between the major jade-producing areas of the Maya and northern Costa Rica. Explaining the hiatus in the frequent occurrence of jade in the intervening area is imperative in understanding the cultural ramifications of either the single- or multiple-source perspective.

Jadeitite or other carved greenstone is almost totally lacking in the area farther south into Nicaragua. Although the paucity of recovered material may reflect limited archaeological research country, the recent survey conducted by Lange and Sheets in spring 1983, which included discussion with longtime private collectors and personnel at the National Museum of Nicaragua, reinforced the notion of a scarcity of greenstone artifacts in Nicaragua. The few pieces that have been recovered tend to be geographically clustered on Ometepe and in the isthmus of Rivas, near the Nicaraguan–Costa Rican frontier. Fletcher and Salgado (n.d.) described some greenstone (jade?) pendants in collections from the northern part of Nicaragua near Esteli. These appear to be rather crude renditions of avian pendants ("low intensity" according to Lange's terminology, outlined in Chapter 20) rather than either a southern extension of the Maya or Honduran carving traditions or the northern extension of the high-intensity tradition (Chapter 20) from northern Costa Rica.

The presence of large numbers of jadeite as well as other greenstone artifacts in northern Costa Rica stimulates speculation of a jadeite source somewhere in the northern part of the country. Even if such a source existed, however, it would fail to inform on the social reasons that greenstone artifacts are lacking in neighboring Nicaragua. Among ceramic artifacts, though some types have panregional distribution, others are restricted to either Nicaragua or Costa Rica. Obviously some social mechanism determined which materials or influences were accepted, rejected, or reinterpreted.

Within the Maya area, provenienced specimens attributable to a compositional group are specimens from the Belizean sites of Cuello and Cerros that were placed into the Costa Rican Light group. If there is a source of jadeite far south of the Motagua Valley, do these specimens constitute empirical evidence of the movement of goods from Costa Rica to Belize? Norman Hammond, in a recent review of the chemical data provided by Bishop, Sayre, and Mishara, observed that for the Preclassic Cuello samples that were placed into compositional groups, those that belong to the Costa Rican Light group occur after A.D. 200. This contrasts to Cuello jades belonging to the Maya Green or Chichén Green groups documented from the late Middle Preclassic at about 400 B.C. (Hammond, personal communication, 1989). The chemical data appear, therefore, to covary with a shift in the archaeological record.

As pointed out in Lange's introduction to this book, movement of Motagua jades to the south, and the hypothetical movement of Costa Rican source jade to the north could have occurred along either the Caribbean or Pacific Coast, or along both. Additional contextual data, both archaeological and geological, are essential to bring interpretations of prehistoric trade routes down from their current highly speculative and general status.

Characterization studies will always require more-extensive sampling, and the potential for the unfound site or unanalyzed specimens to revise current models will persist. Whether or not a mineralogical data base interpreted within a framework of a particular theory of plate tectonics and postulated jadeitite formation processes represents a better picture of reality than a numerically analyzed data base of elemental concentrations will be determined in the future. Perhaps the archaeological data base is currently the strongest; if so, it may be because it is more easily envisioned—that is, jadeite artifacts occur in two noncontiguous areas, with limited to no occurrence of carved greenstones in the lands between.