CHALCHIHUITL—A STUDY IN JADE

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Abstract

The Aztec gem stone *chalchihuitl* is jadeite, or its congeners diopside-jadeite and chloromelanite. The various categories of chalchihuitl recognized by the Aztecs are identified. Its occurrence with the serpentine rocks of Guatemala is suggested, and a natural occurrence in the Motagua Valley is recorded.

Introduction

When the Spanish explorers of the early 16th century reached the coast of Mexico, they found a bright green stone in use among the inhabitants of the region which the indigenous lapidaries fashioned into ornaments and figurines. The early chroniclers, impressed by the vivid green color of the stone and by the great value placed upon it by the natives, referred to it as emerald. This is not surprising since they had no previous experience with a stone of this nature, and the superior quality of the emeralds recovered as loot from the Incas of Peru, and later from the mines of Colombia, was not yet known to them.

The Aztecs of Mexico, who particularly esteemed this stone, and demanded it in tribute from their vassals, called it *chalchihuitl* (pl. chalchiuine; combination form, chalchiuh-) and restricted its use to the emperor and the nobles.

Nomenclature

The Friar Bernardino de Sahagun first referred to this stone as emerald in his monumental work on Aztec culture written in 1530, "*Historia general de las cosas de Nueva España*," and he was followed by later chroniclers, Peter Martyr (1530), Martinus de la Cruz (1552), Lopez de Gomara (1554), Molina (1571), Acosta (1590), Tezozomoc (1598), Herrera (1601–1615), Torquemada (1613), and finally Carochi (1645). That the so-called emerald was actually chalchihuitl is indicated by Tezozomoc, who refers to "emeralds and many other kinds of chalchihuitl stones," "Emeralds and other chalchihuites," etc. Herrera states that the Tlascalans called Cortes "Calchihuitl, which is as much to say Captain of Great Valor, because chalchihuitl is the color of emerald, and the emerald is highly prized among the natives." Molina in his early Mexican dictionary defines chalchihuitl as unpolished emerald, but "esmeralda" as "quetzalitztli."

Under the term chalchihuitl, the stone was also referred to by Cortes

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(1519*a*), Motilinia (1541), Molina (1571), Palacio (1576), Castañeda (1580), Herrera (1601–1615), Torquemada (1613), and Diaz del Castillo (1632).

Cortes (1519*b*), (except in his doubtful merced 1519*a*), and Duran (1585), refer to the material only as "greenstone." Those who define chalchihuitl simply as "precious stone" are Rincon (1595) and Vetancourt (1673).

There is no evidence that the indigenous population used this stone, except sparingly, for anything but ceremonial objects and ornaments. Compounded with various herbs, and with a green pearl added, the fine green chalchihuitl served in cures of a fracture of the head, for fever, gout, and it was even efficacious to revivify a dying person (Martinus de la Cruz, 1552). The Spanish conquerors enhanced its value further by imputing to it the virtue of alleviating pains of the side and the kidneys. A great many carved ornaments of chalchihuitl were brought to Europe from New Spain where they commanded fancy prices and brought high profits to the early freebooter. The physician Nicolas Monardes first mentioned them as *piedra de yjada*, or "stone of the loin" in his work on the medicines of the New World (1569). Others referring to this stone as piedra de ijada were Palacio (1576), Acosta (1590), Herrera (1601–1615), and Vazquez (1612). Translated into French this term became *pierre de ejade* or, simply, *jade*. In the Latin translations of the Spanish works, the term became *lapis nephriticus*. The Latinized form gave rise to the mineralogical name *nephrite*, first used by Werner (1780).

Within fifty years after the Spanish conquest of Mexico, the supply of jade for amulet use became practically exhausted, because the stones in the possession of the nobles were by then already sold (Monardes), and the knowledge and appreciation of this gem in its original home was soon forgotten.

In the early 17th century a stone of somewhat similar qualities found its way into Europe from Persia, India and China, and, assuming the virtues of the American stone, became known also as jade. Damour (1846) investigated the Chinese material and recognized it as a form of tremolite, or "jade nephritique." Later (1863) he discovered a second mineralogical form of Chinese "jade," a sodium aluminum silicate, and a new species, which he named *jadeite*. Continuing his studies on jade, he found (1881) that jade objects from Mexico were also jadeite. By this time, however, the term jade had become so closely associated with the Asiatic stone that many authorities ignored the existence of the American mineral, or imputed to it an Asiatic origin. Dana did not recognize jadeite as a species until his 5th edition (1874), and then referred the mineral to the Chinese stone. Nephrite, he states, was brought from

Mexico or Peru, in the form of ornaments. It must now be recognized that in a historical and etymological sense jade, and jadeite, is an American stone.

Chemical Composition of Chalchihuitl

A recent study of Meso-American jade (Foshag 1954) demonstrates that the American stone includes a much wider range in physical aspect and mineralogical character than the Asiatic mineral. All Meso-American jade proves to be jadeite or its mineralogical congeners; no true nephrite has yet been found among the artifacts of that region. In previous investigations (Damour 1865), (Clarke and Merrill 1888), (Washington 1922), the samples analyzed contained varying proportions of albite (up to 90 per cent), and from such analyses attempts were made to calculate the composition of the jadeite portion. The new analyses, here given, were made upon carefully purified jadeite; the homogeneity of the samples was checked with the aid of the petrographic microscope.

Optical examination had shown that a considerable range of chemical variation was to be expected in the Meso-American jadeites. The analyses demonstrate that jadeite, diopside-jadeite, and chloromelanite are represented among the objects studied.

Analyses of Jadeite

	1	2	3	4	5
SiO_2	59.51	59.35	58.21	58.12	58.26
TiO_2	0.01	0.18	0.04	0.31	0.04
Al_2O_3	24.31	22.18	23.72	20.32	22.23
Cr_2O_3	0.01		n.d.	0.01	none
Fe_2O_3	0.35	1.15	0.91	2.49	0.71
FeO	0.03	0.32	0.24	0.77	0.21
MnO	0.01	0.01	0.04	0.07	0.03
MgO	0.58	1.77	1.20	2.16	2.18
CaO	0.77	2.57	1.79	3.13	3.72
Na_2O	14.37	12.20	13.07	12.43	11.91
K_2O	0.02	0.20	0.18	0.10	0.40
H_2O	0.06	0.20	0.46	0.16	0.44
	100.03	100.15	99.86	100.07	100.13

1. Jadeite, Burma. E. Zies, analyst, in Yoder (1950, p. 229).
2. "Blue jade," Mexico. Joseph Fahey, analyst.
3. Jadeite, rough, Manzanal, Guatemala. W. F. Foshag, analyst, in Foshag and Leslie (1955).
4. Jadeite, from pea green colored celt, Guatemala. Joseph Fahey, analyst.
5. Jadeite, from jade workers' tomb, Kaminaljuyu, Guatemala. Joseph Fahey, analyst.

ANALYSES OF DIOPSIDE-JADEITE

	1	2	3
SiO_2	55.50	56.28	57.50
TiO_2	none	0.03	
Al_2O_3	12.33	12.18	12.10
Cr_2O_3	none	none	
Fe_2O_3	1.41	0.85	
FeO	1.33	1.28	
MnO	0.05	0.13	
MgO	8.72	9.02	9.60
CaO	12.76	12.60	13.40
Na_2O	6.94	6.94	7.40
K_2O	0.25	0.25	
H_2O	0.30	0.30	
	99.59	99.80	100.00

1. Diopside-jadeite (tuxtlite), Tuxtla Statuette. H. S. Washington (1922, p. 5).
2. Diopside-jadeite, rough fragment from tomb, Kaminaljuyu, Guatemala. Joseph Fahey, analyst.
3. Diopside-jadeite. Theoretical composition for $Di_{50}Jd_{50}$.

ANALYSES OF CHLOROMELANITE

	1	2
SiO_2	57.39	56.45
TiO_2	0.44	
Al_2O_3	18.93	17.02
Cr_2O_3	none	
Fe_2O_3	4.45	7.62
FeO	0.81	
MnO	0.09	
MgO	1.92	2.32
CaO	2.74	4.76
Na_2O	12.46	11.46
K_2O	0.11	tr.
H_2O	0.54	
	99.88	99.63

1. Chloromelanite from grayish green celt, Guatemala. Joseph Fahey, analyst.
2. Chloromelanite pebble, Ouchy, Switzerland. Damour (1881).

VARIETIES OF CHALCHIHUITL

The finest and rarest quality of oriental jade is the so-called fei-t'sui, or king-fisher jade. Its color is emerald green, its diaphaniety is almost crystalline, and its luster on polished surface is pearly. A similar quality

of jade occurs among the Meso-American stone. Like the Chinese material, it is rare and occurs only in small pieces. It has been found in Olmecan pieces in the form of tubular beads and "jaguar claws."

Fine green jadeite, evenly colored or mottled with white, indistinguishable in many pieces from the fine Burma jadeite, is found in all cultures from the Pre-Classic (Archaic, Middle Cultures) to Aztec times. Some of the finest stone is found in Olmecan ear-plugs and figurines.

Celedon green jadeite, often coarse, distinctly grained, vitreous and uniformly colored, is a common form among the highland Mayan carvings. It shows little admixture of extraneous minerals. It resembles the pale forms of prehnite, which is also found among Meso-American artifacts.

A rather uniformly colored jadeite, without apparent grain, pale bluish-gray or greenish-gray, and varying in all nuances to dark ivy green to almost black, was much favored by the Olmecan artisans, and is almost the only jade known to the Nicoyans of Costa Rica. A common feature is the presence of white ghost-like spots within the body of the translucent stone.

Another distinct form of jadeite is uniformly pale gray in color, opaque with a texture of stubby reticulated prisms. It was widely used for celts among the highland Maya, and occasionally fine carved masks in the Olmecan culture.

A pea-green vitreous jadeite, evenly colored and textured, is abundant in the form of celts among the highland Mayan cultures.

A bright to dark green jade (diopside-jadite) widespread among the Mayan cultures, is often indistinguishable from the green forms of jadeite, except by careful examination.

A very dark green to black stone is the ferrian form of jadeite, chloromelanite, not unlike the European chloromelanite in composition. It is common in Guatemala in the form of celts and other utilitarian tools, and occasionally in objects of artistic merit. It has been found in all highland cultures from the Archaic to the Colonial, and ancient celts recovered at archeological sites are still used by Guatemalan potters.

Among the Aztecs, chalchihuitl was the most precious of substances. As an indication of its value, one may quote Moctezuma's words, as recorded by Bernal Diaz del Castillo (1632), upon an occasion of paying tribute to Cortes: "I will also give you some very valuable stones, which you will send to him in my name; they are chalchihuites and are not to be given to anyone else but only to him, your great Prince. Each is worth two loads of gold." The greatest virtues were comparable to this stone. A father, addressing his daughter upon reaching the age of discretion, tells her "Although you are but a little damsel, you are as precious as a chalchihuite" (Sahagun 1530).

The Aztecs had their nomenclature to distinguish the various grades or categories of this stone. The generic term was chalchihuitl. Mena (1927) derives this term from *xalli*—sand, *xihuitl*—herb, that is, a granular herb-colored stone. Objection can be made to Mena's derivation of *xihuitl* as "herb" or "herb-colored," since this root appears in the names of other gem stones that are not green; e.g., *teoxihuitl* (turquoise), *tlapalteoxihuitl* (amethyst). Another, and perhaps more logical derivation is from *xalli*—sand or sandstone, *xuihtic*—green or blue, *iuitl*—plumage of birds; that is, a granular stone the color of a bird's green plumage.[1] Since the plumage of certain tropical birds were used extensively in adornment, and were considered of great value, the comparison of a precious stone with precious plumage is logical in the poetic speech of the Aztecs.

Sahagun describes chalchihuite as "green and not transparent mixed with white." This is the common variety of jade often seen in Meso-American objects, and is similar in appearance to the modern Burmese jadeite.

Quetzalchalchihuitl: Quetzalli—feathers of the *quetzaltototi* (the quetzal), *chalchihuitl*—jade; that is, jade the color of the plumage of the quetzal. Sahagun states "it is very green and has no spots, and is transparent and very green; those that are not have spots and streaks." Molina defines it as "precious stone of a blue or green color." This is the high quality jade as one sees it in fine Olmecan pieces, and is comparable in appearance to rich, evenly colored Burmese jade.

Iztacchalchihuitl: Iztac—white, *chalchihuitl*—jade. Sahagun describes this stone as "white with veins of green or clear blue, also they have other colors mixed with the white."

The etymology of the word and Sahagun's description suggest that this stone is the white variety of jadeite, or jadeite mixed with albite. Both forms are not uncommon among Mexican and Guatemalan objects.

Quetzalitztli: Of this stone Sahagun remarks, "The emeralds that are called quetzalitztli, of which there are very good ones in this land, of great value, are so-called because quetzalli means very green feather, and itztli obsidian, and which is highly polished and without spot or flaw, which are characters of good emerald."

Sahagun was the first to refer to "esmeralda" in Mexico, but no occurrence of emerald is known in Meso-America, and no emeralds have been found in archeological sites north of Panama. It is suggested, here, that this stone is the finest quality of jade, similar to the Chinese fei-t'sui jade, emerald green in color, flawless, and almost transparent. This opinion is supported by Monardes, who states that the finer qualities of

[1] Nahuatl is a highly agglutinative language, in which many roots may be combined into a single formidable word.

"piedra de ijada," that is, chalchihuitl, resemble emerald. Both Molina and Carochi define quetzalitztli as "emerald."

Tlilayotic: Tiltic—black, *ayotic*—adjectival form of *ayotl*, gourd, that is dark gourd colored. According to Sahagun, it "is a form of chalchihuitl, a mixture of green and black."

Leon (1938) renders this term malachite. Sahagun classes it among the jaspers. The word does not appear in Molina. The mineral referred to probably represents chloromelanite.

Xiuhtomolli, xiuhtomotetl: xiuhtic—green or blue; *tomo*—bone; *tetl*—stone; a green or blue bone-like stone. Sahagun describes it "is like chalchihuitl, green and white mixed, it is beautiful." "They bring it from Guatemala and Soconocho." The green and white color suggests amazonstone. Some of the amazonstone from this region may be said to have a bone-like aspect. Both Molina and Carochi render the word as turquoise. It was used in mosaics in the same manner as turquoise. Good examples of amazonstone are found among the artifacts of Guatemala. It is probably not chalchihuitl as Sahagun suggests.

Sahagun also mentions "chalchihuites fingidos," false chalchihuitl, used by the common people to whom the use of chalchihuitl was denied. This may have been any one of the lesser stones found in archeological deposits, probably the mottled green metadiorite.

Occurrence

The widespread use of jadeite in hard-stone carvings in Meso-America, and the lack of an evidence of a local provenience have led some students of early American cultures to postulate an extraneous source of this material, possibly the Orient. This postulate ignores the fact that many varieties of Meso-American jade have not been found anywhere else in the world. Since the oriental jadeite was unknown until its discovery in Burma in the 18th century, A.D., the use of jadeite in America antedated its use in the Orient by more than 2,000 years.

All known occurrences of jadeite *in situ* are associated with serpentine (Burma, Chibber 1934; California, Yoder and Chesterman 1951; Japan, Iwao 1953; Celebes, de Roever 1955). In all cases albite is an important and intimate associated mineral. Minerals occurring as minor accessories are quartz, analcime, nepheline, pectolite, actinolite or tremolite, garnet, lawsonite, mica, chlorite, natrolite, zoisite and sphene.

The Meso-American jadeite frequently contains abundant low-temperature albite ($\alpha = 1.526 - 1.528 \pm .001$, $\gamma = 1.537 - 1.539 \pm .001$), much of the stone varying from albitic jadeite to jadeitic albite. Other accessory minerals in this jadeite are muscovite, common but not abundant; sphene, hornblende, actinolite, zoisite, and chromite, all rare. In the chloromelanite, albite is rare; garnet, sometimes common; sphene, anal-

cime, epidote, hornblende and glaucophane, rare.

The character of the Meso-American jadeite, and its mineral associates suggest that, like jadeite in other occurrences, it will be found in close association with serpentine.

Recently an occurrence of jadeite has been discovered near the village of Manzanal in the Motagua valley of Guatemala, in close proximity to the serpentine area of the Sierra de las Minas (Foshag, W. F., and Leslie, Robert 1955). The nature of the find and the character of the stone suggest that it was a source of material for some of the ancient indigenous cultures, particularly of the highland Mayan cultures of the Quiché region of Guatemala. Archeological finds in and about the Motagua valley further suggest that this region was a center of jade-working and dispersal (Foshag 1954).

Other areas of serpentine that may contain jadeite deposits are the Sierra de Chuacas, along the north slope of the Motagua valley; an area south of the Rio Negro, extending from Zacapulus to Santa Rosa; and an area along the western shore of Lake Yzabel; all in Guatemala; and a small area near Chimalapa, Chiapas, Mexico (Sapper 1937). A small area near Tehuitzingo, Puebla, was examined for jadeite by the writer, without success. Another small area in Mexico near Victoria, San Luis Potosi, presumably is beyond the limits of the cultures that appreciated jade.

References

Acosta, Jose de (1589), De natura Novi Orbis, Salamanca; (1590), Historia natural y moral de las Indias, Seville: *ibid.;* Markham ed., Hakluyt Soc. Pub. nos. 60–61, London (1880).

Carochi, Horacio (1645), Compendio del Arte de la lengua Mexicana: Gonzalez y Montoya ed., Puebla (1910).

Chibber, H. L. (1934), The mineral resources of Burma: pp. 23–77. London.

Clarke, F. W., and Merrill, G. P. (1888), On nephrite and jadeite: *Proc. U. S. Nat. Mus.*, **11**, 115–130.

Cortez, Hernan (1519*a*), Merced de Hernan Cortes á los caciques de Axapusco: in Garcia Icazbalceta, Joaquin, Coleccion de documentos para la historia de Mexico, **2**, 7–8 (1866). (This merced may be apocryphal. W. F. F.)

———. (1519*b*), Lo que enbió de la Nueva España el Capitán bernando Cortes. (Cortes and his first official remission of treasure, by John Tate Lanning: *Rev. His. America*, **1**, 1938).

Damour, A. (1846), Analyses due jade oriental: *Ann. Chem. Phys.*, 3d series, **16**, 469–474.

——— (1863), Notice et analyse sur la jade verte. Reunion de cettes matière minéral a la famille wernerites: *Compt. Rend.*, **56**, 861–865.

——— (1865), Sur la composition des haches en pierre trovées dans les monuments celtiques et chez las tribus sauvages: *Compt. Rend.*, **61**, 357–368.

——— (1881), Nouvelles analyses sur la jadeite et sur quelques roches sodiféres: *Bull. Soc. Minéral France*, **4**, 156–160.

Duran, Fray Diego (1585), Historia de las Indias de Nueva España: Mexico (1880)

Diaz del Castillo, Bernal (1632) (ms. about 1532), Historia verdadera de la conquista de la Nueva España: Trans. A. P. Maudslay. Hakluyt Soc., London (1901).

Foshag, W. F. (1954), Mineral studies on Guatemalan jade: ms. in Instituto Antropologia Historia Guatemala.

———, and Leslie, Robert (1955), Jadeite from Manzanal, Guatemala: *Am. Antiquity*, **21,** 81–83.

Garcia de Palacio, Diego (1576), Carta dirijida al Rey de España: Trans. A. V. Frantzius 1873; also in Squier, E. G., Collection of rare and original documents concerning the conquest of Mexico, New York (1860).

Gomara, Francisco Lopez de (1552), La Conquista de Mexico, Zaragosa. Mexico (1943).

Herrero, Antonio de (1601–1615), Historia general de los hechos de los Castellanos en las Islas y Tierra Firme de Mar Oceano: Madrid.

Iwao, Schūchi (1953), Albitite and associated jadeite rock from Kotaki District, Japan: A study in ceramic raw material: *Geol. Sur. Japan, Rept. no.* **153,** 1–25.

Leon, Nicolas (1938), Ensayo de nomenclatura e identificacion de las laminas 98–138 del libro XI de la Historía de las Cosas de Nueva España: In Sahagun (1938).

Martinus de la Cruz, and Badianus, Juannes (1552), Badianus manuscript (Codex Barberini): Trans. Emily Walcott Emmart, Baltimore (1940).

Martyr, Peter (1530), De Orbe Novo: Alcala. MacNutt trans. (1912).

Mena, Ramon (1927), Catalogue de la coleccion de objetos de jade: *Museo Nacional (Mexico), Dept. Arqueologia.*

Molina, Alonso de (1555), Vocabulario en lengua Castellana y Mexicana: Mexico. Madrid. (1944).

Monardes, Nicol (1569), Primera y segunda y tercera parte de la historia medicinal de las cosas que se traen de las Indias Occidentales que sirven en medicina. Seville. Also, Joyful newes from the Newe Worlde, written in Spanish by Nicolas Monardes, physician of Seville, and English ed. by John Frampton, merchant. London (1577); ed. Sir Stephen Gaselee, London (1925).

Motolinia (Benavenuto, Toribio de) (1541), Historia de los Indios de Nueva España: Mexico (1941). Also ed. Elizabeth Andros Foster, Berkeley (1950).

Rincon, Padre Antonio de (1595), Arte Mexicana: Mexico; ed. Peñafield, Mexico (1888).

De Roever, W. F. (1955), Genesis of jadeite by low grade metamorphism: *Am. Jour. Sci.*, **253,** 283–298.

Sahagun, Fr. Bernardino de (1530), Historia general de las cosas de Nueva España. Mexico (1938).

Sapper, Karl T. (1937), Mittel Amerika; Handbuch der regional Geologie, Heidelberg.

Tezozomoc, Ferdinand Alvarado (ms. ca. 1589), Cronica Mexicana: Ed. Orozco y Berra, Mexico (1944).

Torquemada, Juan de (1615), Monarquia Indiana: Seville; Madrid (1723); Mexico (1943).

Vazquez de Espinoza, Antonio (1612), Compendio y descripcion de las Indias Occidentales. Trans. Charles Upson Clark; *Smithsonian Misc. Coll.*, **108,** Washington (1948).

Vetancourt, Fr. Augustin de (1673), Arte de lengua Mexicana. Mexico (1673), (1901).

Washington, Henry S. (1922), The jades of Middle America: *Proc. Nat. Acad. Sci.*, **8,** 319–326.

Werner, Abr. Gottlob (1780), In Cronstedt's Mineralogie (1758), translation by Werner.

Yoder, Hatton S. Jr. (1950), The jadeite problem: *Am. Jour. Sci.*, **248,** 225–248, 312–334.

———, and Chesterman, C. W. (1951), Jadeite in San Benito County, California: *Calif. Div. Mines, Special Rept.* **10-C.**