5. The lexical similarities between the American Indian languages and the Caucasian dialects consist in the resemblance of their numeral systems. In almost all Caucasian languages and in many languages of Central America, Mexico and Pacific Coast a system of numerals having twenty for basis is used [1]. In the other languages of the world the decimal system is the most widespread.

6. The easiest explanation of similarities in the structure of the systems of the Caucasian and American languages is the hypothesis of the existence of a great Convergence Area in Central Asia for several millenia B. C. Languages — members of the Area — though belonging to different families, owing to mutual contacts created phonological, morphological, syntactical and lexical systems much like one another. The essential features of these similar systems are preserved till now in spite of the fact that ethnic shiftings placed some languages in Caucasus and other on the Pacific Coast of North America.

The distribution of the common structural features of the linguistic systems analyzed here confirms our suggestions. It is true that some of them occur in the other languages of the world but the whole set or a large part of it is only found in the Caucasian languages referred to and those of the extreme northeast corner of Asia (the Chukchi-Kamchadal family) and west area of North America, i. e. among other in the part of Asia nearest America and the part of America which is nearest Asia.

The great majority of South American languages, the Penutian family of California as well as the languages of the Atlantic Coast in North America belong to a completely different type. Those languages from the oldest linguistic layer of America and the newcomers from Asia, speaking dialects similar to the Caucasian and Chukchi-Kamchadal languages, were piled one upon the other. That is why the languages with structural features analyzed here are found in the areas of America situated nearer Bering Straits while those deprived of them are in more distant areas.

[1] Cf. A. Dirr, *Einführung in das Studium der kaukasischen Sprachen*, Leipzig 1928; and P. W. Schmidt, *Die Sprachfamilien und Sprachenkreise der Erde*, Heidelberg 1926, p. 357—380.

JAN KINLE

JADEITE — ITS IMPORTANCE FOR THE PROBLEMS OF ASIA — AMERICA PRECOLUMBIAN RELATIONSHIPS

The greatest difficulties in studies on jadeite are created by the terminology. In French and English literature nephrite and jadeite are defined by a joint term „jade" used independently of mineralogical names. Authors very often use in publications the term „jade" when writing about these minerals, not explaining however, which of the two kinds is concerned, the result of which is that these works are comprehensible only for a specialist. As a result of these terminological inexactitudes, an archaeologist is mainly using the term „jade" to define nearly all green, untransparent, stones, of hardness above 6 in Mohs scale. A term also very often used by an archeologist is „greenstone", referring generally to all green stones, serpentine included. As regards the exact term „jadeite", it appears in archaeological and ethnographical literature very often, but in most cases it is used unproperly, mostly with reference to related or similar minerals. Minerals which are found as ready objects in the following countries are considered as jadeite [1]:

1. Chloromelanite (Korea, Japan; Mexico, Egypt, USA).
2. Nephrite (China, India, Germany, America).
3. Fibrolite (Japan, Alaska).
4. Grossular (Transvaal).
5. Bowenite (Kashmir, China, America).
6. Californite (idocrase) (America).
7. Pectolite (Alaska).
8. Amazonite (Amazon jade).
9. Saussurite (Switzerland, USA, Italy, Germany).
10. Verdite (Transvaal — „African Jadeite").

[1] H. Smith, *Gemstones*, London 1949; R. Webster, *More about Jades*, „The Gemmologist", Vol. XXVIII, Nr. 338, 1959, p. 166—168.

Taking into consideration that the only deposits available for exploitation on a larger scale are in Burma [1] and therefore jadeite could be an essential indication in investigations on commercial routes of the antiquity — the erroneous definition of this mineral makes its utilisation in research works useless.

As shown above, a specialist investigating the jadeite question, especially in its historical aspect, can base on literature only in a limited degree and must continue his studies first of all on the basis of direct excavations materials, that are not always available.

This paper, being a preliminary recapitulation of recent investigations, has for its object the jadeite, one of the main minerals in fixing commercial routes and sometimes even an age index of cultural deposits.

Jadeite is a mineral of pyroxene group of a chemical formula Na AL $(SiO_2)_2$. It crystalizes in a monoclinal system. It has two directions of splitting (93°). Its specific gravity is constant in principle and amounts to 3,33 only rarely indicating deviations amounting to $\pm$ 0,03. The refractive indices for the single crystals are near 1.654 and 1.667. The absorption spectrum is characterized by the presence of a diagnostic for jadeite line in the blue — violet at 4375 A°. It is a meanly hard mineral (7 in Mohs scale), but by its inner rather compact structure gives an illusion of higher hardness which considerably impends carving. It is not much translucent, with a greyish-green, emerald-green, white-green, green, apple-green, blue-green, and white shade. The most precious kind is the relatively rarely found emerald-green one, but it appears only as small inclusions among other kinds. Valuable and maybe most characteristic of Burma deposits is the emerald-green jadeite with white streaks and spots. It possesses a high lustre increasing considerably after polishing. The polished jadeite, especially its emerald-green kind with its greasy lustre, translucency and characteristic sugar-like crystalline structure is relatively easy to be distinguished by a specialist from other similar minerals, even without any

[1] R. Webster, *The Jades*, „The Gemmologist", vol. XXVIII, Nr 337, 1959, p. 157.

special analyses [1]. The jadeite blocs, which lie in alluvial deposits are weathering and covering themselves with a light-brown skin. Such skin is also to be seen on the surface of jadeite objects which lie a long time under the ground in the domain of soil waters. The colour and exterior appearance of the skin is a rather subtial indication for defining the kind of raw material — this is some times essential for avoiding cutting of blocs or damaging objects.

In principle jadeite appears in serpentine rocks, accompanied by albite. It can also be found as small lamines in nephrite. In serpentine it lies in rather thick seams what enables drawing out of rather big blocs, but because of considerable changeability in kind even in small blocs and impurities of other rocks, the real quantity is generally lower than that apparently quarried.

The only deposit suitable for exploitation and assuring supply of raw material for centuries is in Upper Burma, in the province Mogoung in region Myitkyina. This mineral is mined from river Uru gravel on a section of about 30 km. up from village Sanka. The sizes of the jadeite blocs are various, generally however are they not big, only in exceptional cases their weight amounts to 500 kg. In the same region in the neighbourhood of the village Tawmaw the jadeite is quarried from a primary rock deposit. This deposit according to F. Noetling [2], who visited it in 1892 is exploited

[1] To represent the essential difference between materials most often considered as jadeite, namely the nephrite and chloromelanite we indicate below their chemical analysis:

	Jadeite	Nephrite	Chloromelanite
SiO_2	58,24	58,00	56,12
Al_2O_3	24,47	1,30	14,96
Fe_2O_3	1,01	—	3,34
FeO	—	2,07	6,54
CaO	0.69	13,24	5,17
MgO	0,45	24,18	2,79
Na_2O	14,20	1,28	10,99
K_2O	1,55	—	traces
TiO_2	—	—	0,19
MnO	—	—	0,47

[2] F. Noetling, *Preliminary report on the economic resources of the Amber and Jade mines area in Upper Burma*, „Records of the Geological Survey of India", Vol. XXV, 1892, p. 130—135.

since about 1870. Jadeite is mined directly from rock by heating and sudden cooling afterwards. This method known and applied in neolitic cultures, is applied at present in Sinkiang in respect to nephrite. It is not an economical method and brings as a result great losses in material, amounting to 70% and more. Taking into consideration the high price of jadeite this method has probably not been applied before, especially as the alluvial deposits were supplying raw material of much better kind.

Boulders exploited from secondary deposits are charaterized by the fact that they have not cracks and are a homogenous material. It is comprehensible if we take into consideration the fact that during water transport in the river bed, the blocks of raw material, if they had had crevices and cracks, they were subject to crushing, and therefore a natural selection was taking place. Raw material selected in such a way was giving a considerable guarantee of compactness and durability, what allowed the carving of big and most precious objects as: vases, cups, figures and so on, without fear of cracks or other damages.

Besides the described deposit the presence of jadeite on the Asiatic continent has not been observed. The jadeite mentioned in Chinese literature as coming from Tibet and the province Yü-Nan has its origin, as shown by recent investigations, in Upper Burma. On the remaining continents there are no jadeite deposits. Except the Burma territory, there are only some very small quantities having only a mineralogical significance.

About the history of exploitation of the Burma deposits we do not know much. Jadeite, to all appearances found in Mohenjo-Daro [1] allows us to suppose that it has been exploited in the third millenary B. C. It results from Chinese literature and excavations that jadeite has been mined probably till the period of the Sung dynasty. From the thirteenth till the eighteenth century we have no information whatever regarding mining and trade in jadeite; it is supposed that the quarries must have been inactive. Since the eighteenth century jadeite has been exploited and in considerable quantites exported to China.

[1] E. J. H. Mackay, *Further Excavations at Mohenjo-Daro*, New Delhi 1938, p. 498, 527.

The greatest quantities of jadeite objects are found in archaeological materials from Middle America and China. The absence of written Mexican chronicles and chronology based mainly on radio-carbon dating makes the fixing of the date of jadeite appearance in Mexico impossible; one can only assume, that it occurred probably betwen 500 and 100 B. C. It seems that most materials regarding commercial routes of jadeite and the history of its exploitation should be contained in Chinese sources. Unfortunately the terminology in the Chinese literature is not clear enough, so that it is very difficult to find even an approximate date of jadeite appearance in China.

The contemporary name of jadeite *fei tsui* was before the name of kingfisher, the feathers of which have been much appreciated as decorative material. It is very difficult to state precisely when this name has been applied to jadeite, however on the basis of the Liu An comments in the work Huai nan Tzu (II-nd century B. C.) during the epoch of Chin dynasty, this term could designate jadeite. We find a more substantial note in the official history of a late Han dynasty Hou Hanshu (I-st century). Therein nuts and *fei tsui* are mentioned as a product coming from the barbarian south-west country. The first undoubtful application of the term *fei tsui* for jadeite we find in the introduction to the *Yü t'ai hsin yung chi* collected by Hsü Ling in Liang dynasty period (VI-th century). In Kuei t'ien Lu, a work written by a great statesman of north Sung dynasty — Ou yang Hsiu (XI-th century), the author mentions a jar belonging to him, carved from a material similar to jadeite, from which a cup being in the imperial treasury was made. The term *fei tsui* has also been applied to dark green nephrite without flaws and cracks of Khotan origin. In lapidarium Yün lin shih pu (1135 A. D.) *fei tsui* is mentioned as a characteristic Khotan product. It was to be a nephrite without the smallest flaws, specially selected from the quarried material. Since the times of Sung dynasty this term has been rarely used and in the first the feathering of kingfisher. Since the Chien-lung period (1736—1796), characterized by a considerable artistic development in the carving nephrite and of jadeite, the term *fei tsui* has been accepted for jadeite and it is applied till now. In 1800 Chi Yün in a collection of reminiscences entitled

Yüèh wei t'ang pi chi is using the name *fei tsui* for the Burma jadeite, when writing among others „... the jadeite objects and raw material are of a rare luxury, their value is much higher than real nephrite value...".

As we see from this, the Chinese nomenclature is creating great difficulties for the study of the question of jadeite. Till the VI-th century there is no precise definition of jadeite and in a literature containing mainly poems one cannot state with certainty whether the authors have in mind the feathering of kingfisher or jadeite, the more so as both materials are used as ornaments and their colour is similar. In Sung times the term *fei tsui* has already three meanings and refers to nephrite from Khotan, jadeite and kingfisher and only beginning from Chien Lung period it may be considered as finally precised and synonymous.

Because of these difficulties we must look for an answer to the question as to when Burma jadeite appeared in China for the first time, in archaeological materials. The archaeological investigations show that the earliest jadeite objects refer to Han dynasty (206 B. C. — 9 A. D.). Besides it is very characteristic that in this period a new method of carving has been introduced, applying metal disks on turning over spindles working on scattered abrasive material. Perhaps this new technology has been a Chinese invention, but taking into consideration the Chinese conservatism, example of which the use of machines for carving nephrite with the construction unchaged from Han times, it seems more probable that this technics came to China from Burma or other Asiatic countries together with jadeite, which is much more difficult to carve than nephrite. This possibility seems to be proved also by the fact, that is has been known in Asia much earlier and was applied already in Mohenjo-Daro [1], where the jadeite objects are also known.

The second region besides China, where jadeite objects appear in great quantities is Middle America.

Mexican jadeite is particularly connected with La Venta culture, where it appears in a dressed state in considerable quanti-

[1] E. J. H. Mackay, *Mohenjo-Daro et la civilisation de l'Indus*, Paris, 1940, p. 111.

ties. As cultures were being accumulated, the quantity of jadeite found in the excavations decreased, giving way to nephrite; in the time of the conquest of Mexico it was a rare, very precious stone much more appreciated than gold. It is worth noting, that some kinds of nephrite met in Mexican objects are similar to the rather characteristic Khotan nephrite. The identification of this material could be carried out after a detailed chemical and petrographical examination.

A great deal of objects found in the area of La Venta culture, has been carved in emerald green, translucent jadeite, sometimes with white stains and streaks. The exceptionally characteristic colour, sugar-like crystalline structure, lustre and great ability to be polished seems to indicate that we have to do with jadeite from Upper Burma deposits. Lack of deposits in Middle America as well as the convergence of Asiatic jadeite features and those of the Mexican ones — the point stressed by M. W. Stirling [1], the American archaeologist, suggest that this stone could have been of oriental quality.

Also other convergences are advocating the conviction that we have to do with Asiatic origin of the Mexican jadeits.

Many objects found in La Venta bear traces of mechanical working i. e. by applying disks working on scattered abrasive material. As mentioned above this technics wa applied in Asia before La Venta period, and is still to-day used in China and in a slightly modified way in India. Jadeite hardness and its great endurance causes that carving by the use of primitive methods observed to-day in Mexico [2] (i. e. by applying hand saws and knives) is exceptionally difficult and could not have given possibilities of obtaining sculptures on such a level of perfection, as the objects found in La Venta. Disks, by the aid of which the carving has been made should not have been made of iron, but of another metal, for instance copper or even a gold, as these metals are very suitable for this aim. Joyce [3] mentions the possibility of

[1] M. W. Stirling, *La Venta's Green Stone Tigers*, „National Geographical Magazine", Vol. LXXXIV, nr 3, 1943, p. 323.

[2] J. Kasper, *Stone and Gem Cutting in Mexico*, „The Gemmologist", vol. XXVIII, nr. 336, 1959, p. 132—137.

[3] T. A. Joyce, *Maya and Mexican Art*, London 1927, p. 176ff.

applying the bamboo drills in Mexico and Hansford [1] supposes that instead of metal disks, disks from hard wood could have been used. We find objects bearing traces of mechanical carving among La Venta culture objects, and others made by primitive methods — the quantity of the latter ones is much greater. It suggest that only a small group of specialists has been acquainted with the secret of using tools, and this fact could explain the dissappearance of this technics in course of time.

Some of the stone articles found in La Venta excavations are amazingly akin not only in their appearance but also in function to similar Chinese objects. Especially many comparisons can be made in respect to nephrite articles [2]. Taking into consideration that the Chinese as well as the inhabitants of Mexico had at their disposal nephrite from regional deposits [3] and therefore the assortment of articles was great, we can observe much more resemblances here than in respect to jadeite, which being a very rare and precious stone, is used therefore only for a limited assortment of articles. Taking the matter on the whole, because of great resemblance of nephrite and jadeite and the opinion that both these stones are most valuable among gemstones, the character of objects made in China as well as in Mexico was the same. However the most excellent sculptures and the most precious objects, being perhaps the works of the highest class of specialists, were made of the most precious stone — jadeite. Among the objects made of jadeite and showing the greatest resemblance may be mentioned: ritual Mexican plates *hachas* [4], resembling similar plates used in China (*kuei*), and flat disks with big holes, with which the sucklings were fed in China, identical with those found in La Venta [5].

Besides the objects resembling the Chinese ones, in Mexico can be found objects, quite peculiar to this country — in the first place the figurative sculpture, which in respect to nephrite

[1] H. S. Hansford, *Chinese Jade Carving*, London 1950, p. 86.
[2] G. R. Thomas, *The Rock of Ages*, „The Lapidary Journal", vol. XIII, nr. 2, 1959, p. 256—276.
[3] R. Webster, *The Jades*, „The Gemmologist", vol. XXVIII, nr. 337, 1959, p. 155—156.
[4] M. W. Stirling, *La Venta's...*, plate IV.
[5] M. W. Stirling, ib., plate IV.

and jadeite was on much higher level than in China. Sculpture of heads, reflecting exactly the features of a face, suggest that they have been made from a model (table); whis we do not find in China. It is to be noted that sculpture of face from a model was made for the first time in China in 1959 [1].

Presuming that jadeite found in Middle America is of Asiatic origin we must examine the question of routes, by that it could have been transported to Middle America. Two possible routes can be considered:

1. by Bering strait by a land or land-sea track, and 2. directly by Pacific — by a sea track.

The first route as regards jadeite can hardly be accepted. Tbere are many reasons for dismissing this possibility. The land track from Burma was running across China, where in the time of La Venta culture jadeite only begins to appear. If the route run in northern direction, ommiting China by a coast track, jadeite and technology of carving should have been known in this period in Korea and Japan; and this has not observed [2]. Besides it is hardly possible that on a gigantic land track existed a transporation of raw material together with the technics of carving and yet, that nations by whose territories the track was passing, did not avail themselves of this technics or material.

The second, direct transpacific route seems the only one to be accepted. Of course the meaning of route cannot be understood as regular relationships by way of a regular communication, but as sporadic contacts, perhaps even one or a couple of casual journeys of ships, loaded with jadeite among other goods. It may be supposed that because of the exceptionally high price of jadeite, the cargo could have been conveyed by specialists, what could explain the fact of transporting the carving technics together with raw material from Asia to Middle America.

The sea navigation of Asia nations was on a high level, higher than in countries of Mediterranean sea basin. Marco Polo whom we owe a very detailed description of Chinese vessels in XIII-th century, recorded their considerable sizes and way of

[1] The figure of Mao Tse Tung made in white Khotan nephrite by Chinese master Wang Ssu Sen. National Museum in Peking.
[2] S. H. Hansford, *Chinese...*, p. 47—48.

building, enabling to undertaking long deep-sea journeys [1]. Fa-hien, a Chinese Buddhist scholar returning from India to China in IV-th century was sailing on vessel having on board two hundred people of crew and passengers. His ocean way was leading directly by Indian Ocean from Ceylon to Java. From Java he was sailing to China on another similar ship. The proof of the very high level of sea navigation in south and southeast Asia countries is the noted in Chinese chronicles -sea- journey to China of Roman envoys in 166 A. D. [2]. The existence of such relationship is confirmed by Roman antiquities of 2-nd century A. D. found in Cambodja of II-nd century [3]. It seems quite probable that in the period between V-th and I-st century B. C. the level of navigation of Asiatic nations could have been as high and the vessels of that time could undertake far deep-sea journeys, even transpacific ones.

As regards ports from which jadeite could be dispatched to Middle America, their location is meeting considerable difficulties because of inadequate archaeological discernment of the south-east Asia area and impossibility of stating who was the exporter of this raw material. Examining however the course of routes by which jadeite could probably be transported from Burma, several possibilities may be indicated: 1. to Red River and further to Hanoi environs and Vietnam Coasts, 2. down Irrawaddy to Rangoon environs, 3. by Mekong to Cambodja, 4. by Yü-Nan to China, and 5. by Assam to India.

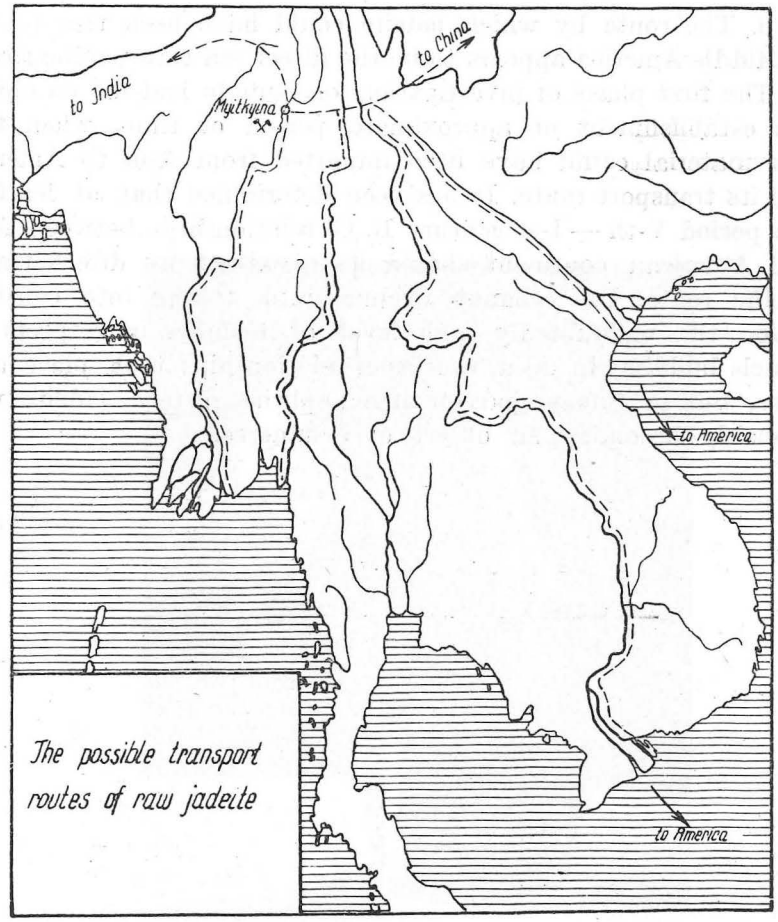
Mostly predestinated are the coasts of Vietnam and Cambodja, because of their best starting position to Pacific and here one should localize ports from which jadeite transport has been sailed. The possibility of such localization relatively to later periods is also pointed out by Heine-Geldern and Ekholm [4] respecting to the other cultural elements.

[1] Marco Polo, *Opisanie Świata*, Warszawa 1954, p. 393.

[2] Shang Yüe, *Dzieje Chin*, Warszawa 1960, p. 94—95.

[3] L. Malleret, *La ville enfouie d'Oc- èo et les sites founanais du Transbassac cochinchinois*, „Actes du XXI-e Congr. Int. des Orient.", Paris 1948, p. 223—224.

[4] R. Heine-Geldern & F. G. Ekholm, *Significant Parallels in the symbolic arts of Southern Asia and Middle America*, „Proc. of the 29-th Intern. Congr. of Americanists", Chicago 1951, p. 309.



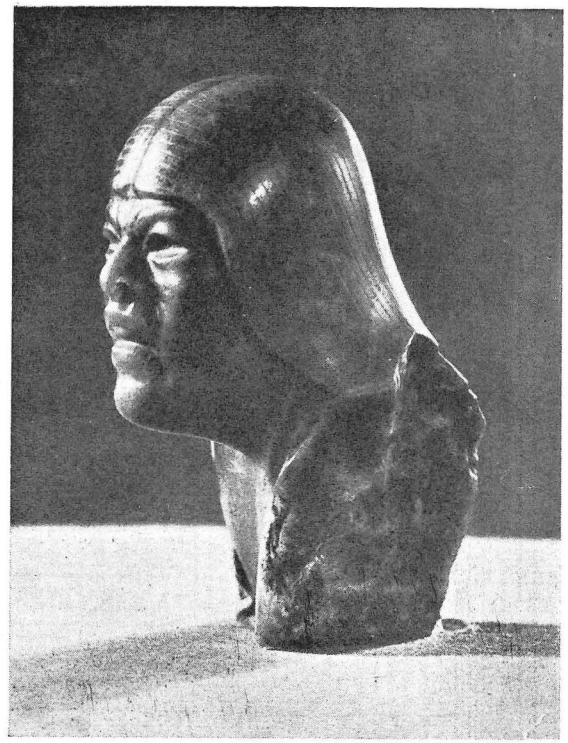
Summing up the above suggestions we can come to the following conclusions:

1. The absence of jadeite deposits in America, resemblance of La Venta jadeite to that of Burma and analogies between objects of La Venta and the Chinese ones, as well as a similar technology, indicate the possibility of importation of Burma jadeite to Middle America between V-th and I-st century B. C.

2. A peculiar and independently existing art which probably developed on the basis of the raw material and technology, imported from Asia initially based on Asiatic forms of art.

3. The route by which jadeite could have been transported to Middle America appears to be the direct sea transpacific route.

The first phase of investigation on jadeite had for its object the establishment of approximate period of time, when this raw material could have been imported from Asia to America and its transport route. It has been determined that at least in the period V-th — I-st century B. C. relationships between Asia and American continent should have existed by direct transpacific route. One cannot exclude also, taking into consideration the undoubtedly high level of technics in respects to vessels building in Asia, that such relationships took place also later, but in this period of time nephrite instead jadeite was probably becoming an object of commerce.



A small head of translucent blue-green jadeite (Olmec) ($2^{1}\ ^{12}/_{16}$'' high) (see p. 239)