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A PETROGRAPHY OF 'JADE-AXES' FROM THE EASTERN AND SOUTHERN NETHERLANDS[1]

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ABSTRACT

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Nine stone axes, examined macroscopically, and by a comparative specific gravity investigation, proved to be made of rocks composed essentially of jadeite. Two X-ray powder diffraction exposures affirmed the results. Since the first petrographical studies of European jadeite implements at the end of last century, the attempts to determine the sources have been without much success. A collection of references of the European jadeites might facilitate the search for the unknown source areas.

INTRODUCTION

To undertake an archaeological study, A. B. DÖBKEN (1978) selected nine polished stone axes from the collections of the State Museum of Antiquities at Leiden in consultation with Prof. Dr. L. P. Louwe Kooijmans, then keeper of prehistory. DÖBKEN looked for axes with more or less oblong, triangular-shaped faces, and a pointed butt on the distal part. He chose implements that were made of rock types known as 'Grünstein' and 'Felsgestein' in the German archaeological literature. With regard to the stoneworking, specimens with a totally polished surface were singled out. The locations of finds lie in the south and the east of The Netherlands. Four of the selected axes were found in South Limburg, two in Noord Brabant and three in Gelderland.

Considering form and geographical distribution, DÖBKEN assigns these implements to the group of West European axes. The dating has been rough due to the indeterminate stratigraphy, and the wide stratigraphical range of the different types of axes in the West-European group, the 9 axes were also mostly loose finds. Their ages, according to DÖBKEN, cover a large range of time i.e. from the beginning of the Middle Neolithicum up to and including early Bronze Age.

PETROGRAPHY

Only non-destructive identification methods could be applied. Macroscopic examination of the axes pointed in the direction of jadeite, nefrite and eclogite. For a closer examination, a comparative specific gravity investigation was carried out. As a check on the results, two powder samples could be taken for X-ray analysis.

Macroscopic examination

As a whole, the axe-shaped rock specimens are massive granulose. Their polished surfaces have a weak vitreous luster, and are subtransculent. The colours vary from light olive grey, greyish green, greyish olive to greenish black. Four axes display a stripy pattern, alluding to a fibrous schistosity, on the smooth, porcellaneous outside.

These above mentioned features fit in with characteristics of either nefrite or jadeite. As two of the rock specimens hold some garnet, they may be taken for eclogites (see Fig. 1). Some feldspar skeleton crystals were observed in the dark green, vitreous crystalline mass of one of the axes.

Although the data considered so far suggest rock species that are nearly all jade, it is obvious that additional evidence is needed.

Comperative specific gravity investigation

Jade is a term used for both nephrite and jadeite. Nephrite, an amphibole, belongs to the tremolite ($Ca_2Mg_5Si_8O_{22}(OH)_2$) - ferroactinolite ($Ca_2Fe_5^{+2}Si_8O_{22}(OH)_2$) series. The replacement of Mg by Fe^{+2} is accompanied by an increase in density. DEER ET AL. (1976), state that members of this series, in which the replacement of Mg by Fe is greater than 50%, are seldom met with.

Jadeite, a pyroxeen, has the composition $NaAlSi_2O_6$, and according to DEER ET AL. (1976), few jadeite analyses depart significantly from this.

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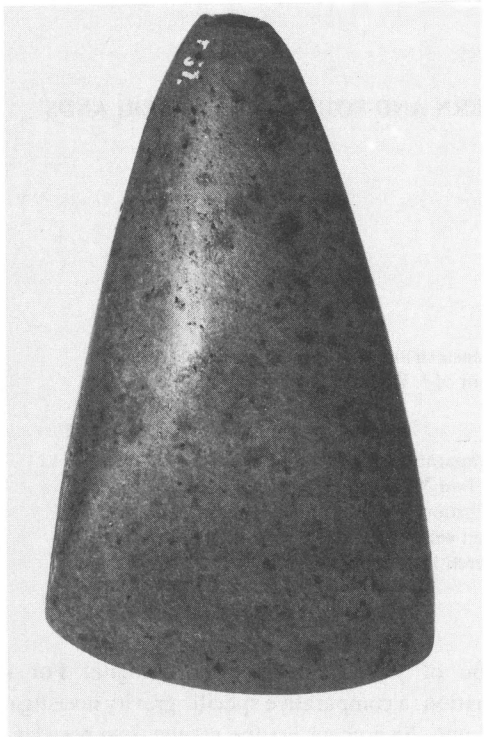

Fig. 1
Axe 37. The round dark spots are sections of garnet.

Since jade axes contain other minerals, such as garnet, feldspar, chromite, magnetite, or quartz, their densities will not be true to pure jadeite or nephrite. For this reason WOOLLEY (1983), made use of the densities of nephrite and jadeite artefacts in compiling a histogram of densities, which is based on 88 determinations of nephrite, and 173 of jadeite. The density ranges in figure 2 are derived from this histogram. The specific gravities of the nine axes, determined by DÖBKEN, are plotted against these ranges. They fall unequivocally within the reach of jadeite.

WOOLLEY (1983) states that the densities of chloromelanite, a black ferruginous variety of jadeite, cluster in the 3.38-3.50 range. The density of I 440 falling within this range but also its dark green, nearly black colour feature chloromelanite.

As a check on the results, two axes, I 288 and I 439 could be sampled for a Debeye Scherrer X-ray analysis. Both powder diagrams show the jadeite pattern.

RESULTS AND DISCUSSION

It is self-evident that petrographic identification is required for a number of approaches of archaeological research on stone, such as evaluating the suitability, and physical properties of the rock type that was selected for certain purposes, looking for correlations between rock variation and artefact typology, making reliable distribution maps, and locating geological sources.

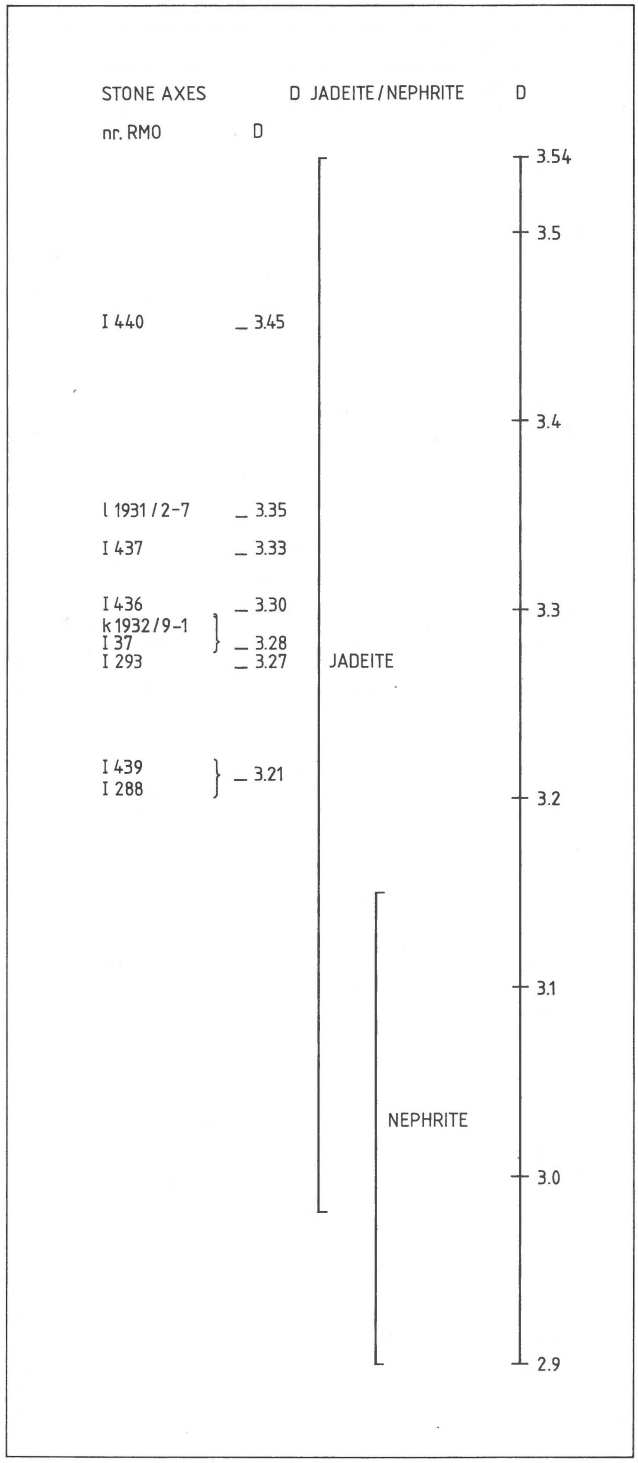

Fig. 2
The specific gravities of the 9 axes compared with density ranges of jadeite and nephrite artefacts. D = specific gravity; nr RMO = registration number of the State Museum of Antiquities.

As the 'Grünstein' and 'Felsgestein' of the 9 axes involved proved to be rocks composed essentially of jadeite, these axes are now of interest to the current archaeological research on jade. Of each axe, the texture, colour, and petrography are given in Table I. The fibrous texture appears as a pattern of the polished axe surface. Actual cleavage directions, facilitating the work of the toolmaker are lacking. Hence, as illustrated in figure 3, it is not surprising that there is no connection between texture and shape of artefact. The striation of the schistosity of I 293 runs right across, more or less parallel with the edge of the axe, but on the face of I 437, the striation runs lengthwise, under an angle of 15° with the longitudinal axis.

To determine the source rock, a comparison with jadeites and eclogites from several localities in Europe, out of the collections of the State Museum of Geology and Mineralogy at Leiden, was without results. Thereupon the axes were submitted to prof. E. den Tex and prof. H. J. Zwart from the Institute of Earth Sciences in Utrecht. Both have a vast experience of European orogenic metamorphism, but, up to now, they have never come across comparable jadeite and eclogite varieties.

The attempts of other investigators looking for European jadeite sources were mostly unsuccessfull except in two cases. HÜGI, (1948), reports that the jadeite of some axes from the pile-dwelling settlements at the Bieler- and Burgäschi lakes may originate from the Canton Wallis. SMITH, (1965) notes that some jadeite occurences in Piedmont might have provided sources for axes in Italy. Despite these exceptions, SMITH, (1965), in his article on the distribution of jade axes in Europe, and WOOLLEY, (1983), in his review on the petrology of jade axes, conclude that the problem of the provenance of the European jadeite axes remains to be solved.

Petrology and mineralogy are essential aids in establishing the provenances looked for. At the outset of a systematic search, as complete a collection as possible of reference of European jadeites should be made. If you are willing to cooperate in starting such a collection, by taking an extra sample for this purpose if you happen to come across a jadeite occurrence in the field, or by sparing a small piece, if you have any jadeite, of which the location is known the author would be greatly obliged if you could send your contribution to the collection to his professional address.

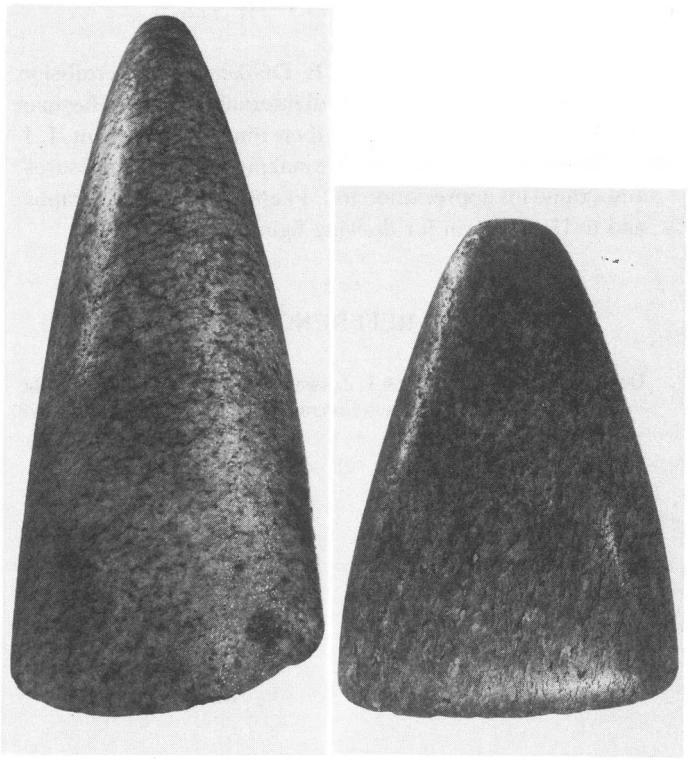

Fig. 3
The fibrous schistosity of axes I 293 (left) and 1437 (right). There is no connection between texture of stone and shape of artefact.

Table I
Further particulars of the 'jade-axes'.

nr. RMO[1]	Texture	Colour[2]		Petrography
	fibrous schistose			
I 439	distinct	light olive grey	5 Y 5/2	jadeite jade (X-ray diagr. 20-2169)
I 293	„	„	„	jadeite jade
I 437	„	„	„	jadeite jade
I 436	less distinct	greyish green	10 GY 5/2	jadeite jade
	unoriented granular			
I 288	granularity visible	greenish grey	5 GY 6/1	jadeite jade (X-ray diagr. 4937)
I 37	„ hardly visible	greyish olive	10 Y 4/2	eclogite
I 440	„ „ „	greenish black	5 G 2/1	chloromelanite
k 1932/9-1	*vitreous crystalline*	dark greenish grey	5 GY 4/1	eclogite
l 1931/2-7	„	„	„	jadeite jade (containing feldspar skeleton crystals)

[1]registration number of State Museum of Antiquities
[2]colour according to Rock-Color Chart

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