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PAOLO M. COSTA and MAURIZIO TOSI

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Sophie Méry*

STUDIES OF BRONZE AGE POTTERY IN THE OMAN PENINSULA: AN ARCHAEOMETRICAL PERSPECTIVE

Thirty years of archaeological research in the Oman Peninsula allow nowadays to consider an in-depth regional study of Bronze Age pottery. Since the seventies, long distance contacts are one of the most discussed themes of the Gulf Archaeology (Berthoud and Cleuziou 1981, Cleuziou 1981, 1984, n.d., Cleuziou and Tosi n.d., Cleuziou and Vogt 1985, During-Caspers 1971, 1972, Frifelt 1975a, 1975b, Potts n.d., Tosi 1976, n.d., Weisgerber 1984).

As far as ceramics are concerned, comparative studies based on similarities of shape or design have contributed to show the deep integration of Magan in the third Millennium Near Eastern World: in a time span of a dozen centuries, there has been an evolution and a shifting of cultural ties between the Oman Peninsula and the surroundings areas.

Thus, some ceramics dating back to three thousand BC have been compared with the Mesopotamian production of the Jemdet Nasr or Early Dynastic I Periods. Around the mid-third millennium, the Oman Peninsula shows strong cultural affinities with the south-eastern region of Iran. Notably, the black-on-grey wares are nearly identical to those of Bampur IV-VI, Shahr-i Sokhta IV, Shahdad and Tepe Yahya IVb, and the incised-grey-wares to those of Bampur, Katukan, and other south eastern Iranian sites. Finally, around two thousand BC, some ceramics are considered to be plain direct importations from the Indus Valley.

However, the morphological and stylistic studies used to demonstrate such contacts are not sufficient because unprecise and subjective. Only an archaeometrical approach, along the lines of Rita Wright's work on black-

* URA 30, CRA, CNRS.

on-gray pottery from Iran and Pakistan should allow to rekindle a currently stalled field of study[1].

Orientation and research themes

To begin with, we will concentrate on the local level, working on the material found in the Al Ain oasis, Emirate of Abu Dhabi (United Arab Emirates). Hili 8 and the Tomb A at Hili North have been chosen as reference sites: Hili 8 has produced a sequence of ceramics for the whole third millennium (Cleuziou 1981, 1984, n.d.) and Tomb A represents today the most complete compilation of funerary wares dating back from about 2250 BC to 2000 BC.

Then we will expand our research to the regional level, contrasting, on the one hand, with the other large areas of Bronze Age sites known in interior Oman, i.e. Bāt, Maysar and Shimal, and on the other hand, with the two coastal sites that are keypoints in the debate concerning long distance contacts, i.e. Umm an-Nar and Ras al-Junayz (Pig. 1).

Then, we will attempt to confirm the contacts with Mesopotamia, south eastern Iran, and the Indus Valley.

The mineralogical and physico-chemical characterization of archaeological ceramics has two principal aims:

– to identify fabric types. We will characterize the different pastes and define the method by which they were prepared: was it non treated, or levigated or else mixed raw clay was used... We will try to distinguish natural temper[2] from added temper. We will also characterize the different types of slip and paint.

– to determine the most likely origin of the ceramics in a well-

[1] The third Millennium pottery in the Oman Peninsula has been the object of a study in an analytical program on mesopotamian ceramic from the Early Dynastic Period. The results of petrographic and neutron activation analysis were published in 1982 by H.S. Mynors. She concluded that there was a movement of Early Dynastic jars from Sumer to Umm an-Nar.

[2] We define temper as all the non-plastic particles included in a ceramic paste, whether this be a natural temper contained in the original clay or a temper voluntarily added by the potter to modify the properties of the clay that he employes.

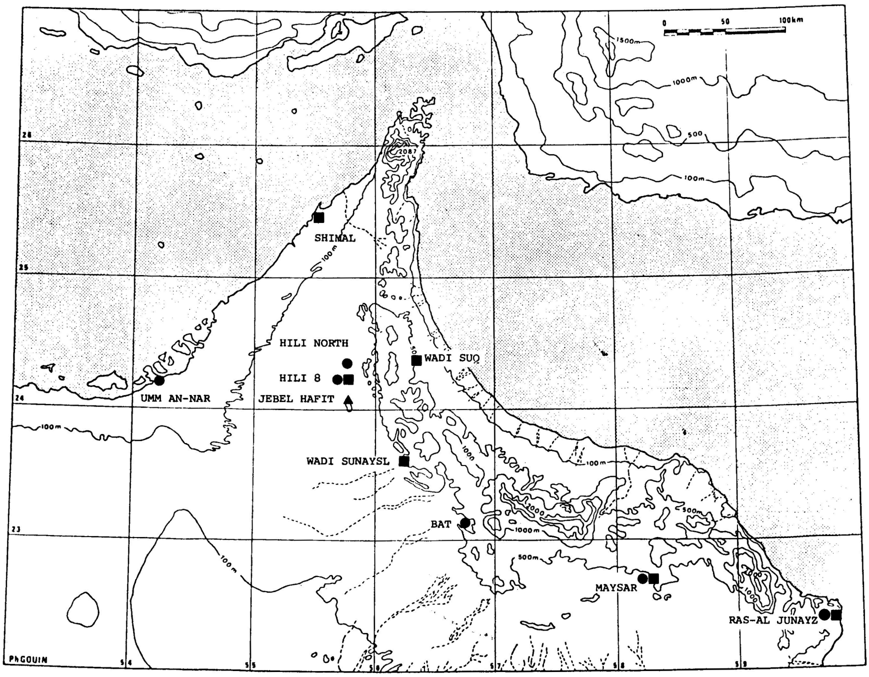


Fig. 1. – Map of archaeological sampled sites (drawing by Ph. Govin).

▲ late 4th millennium BC
● 3rd millennium BC
■ early second millennium BC

defined typologically context and to establish a distributional map of the products.

There are two major limitations to ceramic analysis: it is almost impossible to identify original clay minerals and to separate the tempering material from the matrix[3].

Above a certain point between 500°C and 700°C, the crystal lattice of the clay minerals is modified due to the loss of its water of constitution. The clayey phase is progressively transformed into a metaphase made of silicated and dehydroxylized minerals which, little by little, are going to recrystallize into complex minerals. Consequently, it is virtually

[3] The matrix is made of argillaceous and non argillaceous particles inferior to 20 microns (Courtois 1976: 10, 11).

impossible to determine the nature of original clay minerals in archaeological potteries, unless the firing has been short or the temperature low.

Tempering material of mineral origin are affected in a different manner by heat: calcite destructures at 894°C, quartz, feldspars, micas and pyroxenes are more or less stable. Vegetals are more or less completely carbonized.

Thus, the firing brings complex and irreversible crystallo-chemical transformations of the original constituents which, furthermore, can also react among themselves. This is to show that cohesion of fired clays has nothing to do with a simple consolidation of jux taposed components.

It follows that the impossibility to analyse separately the tempering fraction is due, not to a technical inability but to the very nature of the materials. The petrographic analysis in thin sections allows, at least partially, to overcome this obstacle: inclusions over 20 microns can be distinguished from the matrix.

An example of paste analysis

The petrographic analysis on thin sections were realized in 1984 at the Rathgen forschungslabor (West Berlin, Germany) under the direction of Professor Joseph Riederer.

We found at Hili 8 settlement, in the levels dating back to the early second millennium BC (Wadi Suq Period) some sherds of unwheeled pottery with a coarse mineral temper. They represent less than 5% of the ceramic assemblage. The bases are flat or roughly convex (Pl. 3), the walls upright, 1 cm thick, with a rounded rim. The fired clay colour varies from beige to brown, lot of sherds have a grey core, most of them have been burned secondarily.

After size and shape of the inclusions, we can distinguish macroscopically two different pastes:

In the first group, the inclusions are rounded, brown or black and measure up to 1,5mm (Pl. 1, Pl. 3).

The sample A49 has been studied on thin section (Pl. 2):

- the matrix is constituted by interlaced paded phylliteous minerals.

– the fine tempering fraction is made of numerous inclusions measuring between 20 and 100 microns: essentially angular with irregular outlines quartz, some plagioclases, alkali feldspars, pyroxenes and hornblendes.

– the elements of the coarse tempering fraction are rounded and for the most part measure about 1mm. We have identified many fragments of altered olivines and some large pyroxenes (they may or may not be uralitized) which can be associated with plagioclases.

In the second group, the inclusions are angular, with irregular shape, brown or black and measure up to 3mm (Pl. 3).

The sample A48 has been studied on thin section (Pl. 4):

– the matrix is made of fine granules of calcite.

– the fine tempering fraction is constituted by numerous dull inclusions which measure between 20 and 150 microns. They are essentially micritic and sparitic grains of calcite, quartz quite numerous and some plagioclases, alkali feldspars, pyroxenes, amphiboles, hematite grains as also small fragments of plutonic rocks.

– the coarse tempering fraction consists of angular rock fragments, with irregular outlines: numerous groups of large plagioclases may or may not be associated with fresh or altered pyroxenes, and some altered olivines. They measure between 150 microns and 3mm.

One sample of comparison from Maysar site 25, the paste of which was macroscopically quite close to the second group, has been studied on thin section (Pl. 5):

– the matrix is calcic, very finely grained.

– the fine tempering fraction is constituted by angular grains up to 100 microns of micritic and microspariric calcite, quartz and fragments of plutonic rocks.

– the coarse tempering fraction, up to 3mm, is made of numerous groups of plagioclases may or may not be associated with pyroxenes, some altered olivines and some phylliteous products of alteration. On the other hand we can identify some large fragments of spathic calcite.

Each of this sample has therefore a particular micro-outlook, but presents common characteristics:

– the matrix has a sedimentary origin: clay (A49), marl (A48, M25-12)[4].

– the tempering fraction is distributed in two distinct granulometric poles.

– the coarse tempering fraction regroups plagioclases, pyroxenes and olivines, which are the constitutive minerals of basic and ultrabasic plutonic rocks (gabbros, peridotites). This is not surprising, considering that Hili 8 and Maysar 25 settlements are found on the edge of the Oman ophiolitic ridges. These ceramics are therefore very probably local wares.

NATURAL OR ADDED TEMPER?

Due to the conditions of sedimentation, the clay minerals in the nature are necessarily mixed with very fine detritic grains. Likewise clay minerals and carbonates are very frequently associated. Claystones are made of at least 50% clay minerals, mixed in variable proportions with detritic minerals (essentially quartz and feldspars), carbonates, iron and manganese oxi – hydroxides, and organic matter. Because of this, the petrographic analysis on thin sections rarely allows to differentiate accurately a natural from an added temper (see Picon 1973:21-24 and Rye 1981:31-36). In fact, the undisputable cases of added mineral temper should be limited to the crushed calcite[5] and the quartz «étonné»[6].

Montagu (1982:13-15 and 21-24), showed that the accepted opinion among archaeologists, according to which a temper was always added to a pure clay, was unfounded. «En effet, un potier préparant sa terre à partir d'une terre brute de carrière n'ajoute pas des particules non plastiques, au contraire, il en retire» (Echallier 1984:12).

[4] 99% of the sedimentary rocks contain variable parts of claystone, limestone and sand. Marls are between claystone and limestone: they contain from about 20 to 80% limestone.

[5] Crushed calcite is seen on thin sections in the form of rhomboedric fragments with angular outlines.

[6] The grains of quartz «étonné» present characteristic indented contours. These burst grains are considered as the result of a process where preheated sand, then sudden cooled, is incorporated by the potter into the ceramic paste (Courtois, *op. cit.*, 16).

and neutron activation analysis», *Proceedings of the 22nd Symposium on Archaeometry*, University of Bradford, March 30-April 3rd 1982: 377-387.

PICON M. (1973) - *Introduction à l'étude technique des céramiques sigillées de Lezoux*. Centre de Recherche sur les techniques gréco-romaines, Université de Dijon 2, Dijon.

POTTS D. n.d. - «The chronology of the archaeological assemblages from the head of the Arabian Gulf to the Arabian Sea (8000-1750 BC)», to appear in EHRICH R.W. ed., *Chronologies in Old World Archaeology*, Chicago University Press, Chicago.

RYE O.S. (1981) - *Pottery technology: principles and reconstruction*. Manuals on Archaeology 4, Taraxacum, Washington.

SHEPARD A.O. (1954) - *Ceramics for the archaeologist*. Carnegie Institution of Washington, Washington D.C.

TOSI M. (1976) - «The dating of the Umm an-Nar Culture and a proposed sequence for Oman in the third millenium BC». *Journal of Oman Studies*, *2*, 81-92.

TOSI M. n.d. - «Ras al-Junayz: a possible Harrapan seaport in Oman», to appear in DURRANI F.A. ed., *First International Conference on Pakistan Archaeology*, Peshawar 1982.

WEISGERBER G. (1984) - «Makkan and Meluhha-third millenium BC copper production and the evidence of contact with the Indus Valley», in ALLCHIN B. ed., *South Asian Archaeology*, Cambridge 1981, Cambridge University Press, Cambridge: 196-201.

WRIGHT R.P. (1984) - *Technology, style and craft specialization: spheres of interaction and exchange in the Indo-Iranian borderlands, third millenium BC*. Ph. D., Harvard University, Cambridge, Massachussets.

Bibliography

Berthoud T. and Cleuziou C. (1981) - «Farming communities of the Oman Peninsula and the copper of Magan». *Journal of Oman Studies*, *6*, (2), 239-246.

Bodin V. (1877) - *Traité des Arts céramiques.* Dessain et Tolra eds, Paris.

Caillere S. et Henin S. (1963) - *Minéralogie des argiles.* Masson ed., Paris.

Cleuziou S. (1981) - «Oman Peninsula in the early second millenium BC», in Hertel P. ed., *South Asian Archaeology*, Berlin 1979, Riemer D., Berlin, 279-293.

Cleuziou S. (1984) - «Oman Peninsula and its relations eastwards during the third millenium BC», in GUPTA S.P. eds, *Frontiers of the Indus Civilization*, Indian Archaeological Studies, New Delhi, 371, 394.

Cleuziou S. n.d. - «A preliminary report on the third to the seventh seasons of excavations at Hili 8», to appear in *Magan*, *2*.

Cleuziou S. and Tosi M. d. - «The southern frontier of the Near East», to appear in Frifelt K. and Sorensen P. eds, *South Asian Archaeology*, Århus 1985.

Cleuziou S. and Vogt B. (1985) - «Tomb A at Hili North (United Arab Emirates) and its connections to the south east Iran and the Greater Indus Valley», in Schotsmans J. and Taddei M. eds, *South Asian Archaeology*, Bruxelles 1983, Istituto Universitario Orientale, Napoli, 332-353.

Courtois L. (1976) - *Examen au microscope polarisant des céramiques anciennes.* Notes et monographies techniques n° 8, Centre de Recherches Archéologiques, CNRS.

During-Caspers E.C.L. (1971) - «New archaeological evidence for maritime trade in the Persian Gulf during the Protoliterate Period». *East and West*, *21*, 21-55.

During-Caspers E. (1972) - «Harappan trade in the Persian Gulf in the third millenium BC». *Mesopotamia*, *4*, 167-192.

Echallier J.C. (1984) - *Elements de technologie céramique et d'analyse des terres cuites archéologiques.* Documents d'Archéologie Méridionale, série Méthodes et Techniques n. 3, Lambesc.

Frifelt K. (1975a) - «On prehistoric settlements and chronology of the Oman Peninsula». *East and West*, *25*, 329-424.

Frifelt K. (1975b) - «A possible link between the Jemdet Nasr and the Umm an-Nar Graves of Oman». *Journal of Oman Studies*, *1*, 57-80.

Hamer F. (1975) - *The potter's book dictionnary of materials and techniques.* Pitman Publishing, London.

Koninklijke / Shell Exploration en Produktie Laboratorium (KSEPL) (1969) - *Geologic map of the Oman Mountains.* KSEPL, Rijswijk (Netherlands).

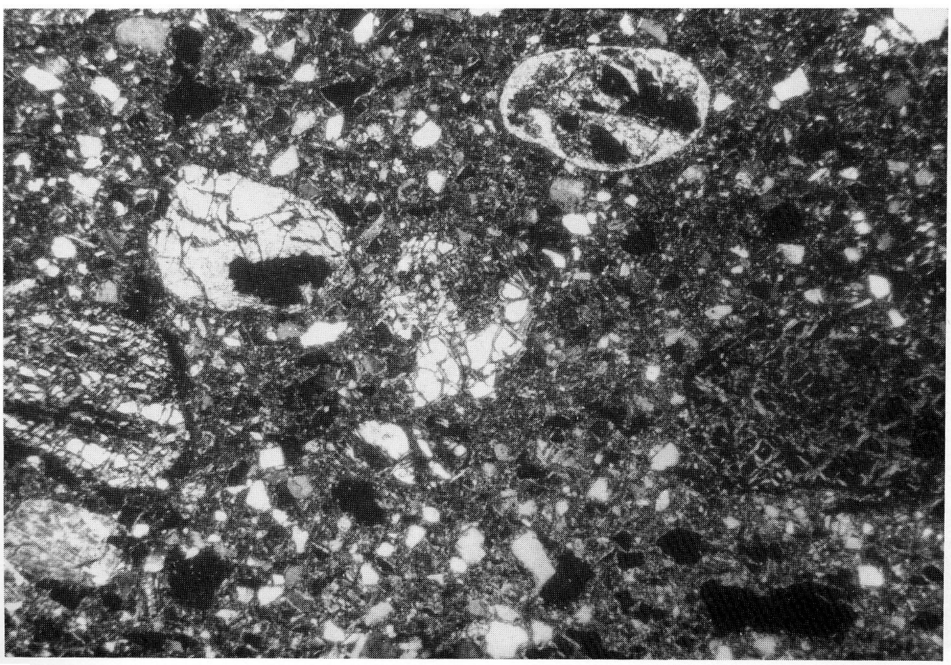
Maggetti M. (1982) - «Phase analysis and its significance for technology and origin», in Olin J. and Franklin A.D. eds, *Archaeological ceramics*, Smithsonian Institution Press, Washington D.C., 121-135.

Millot G. (1964) - *Géologie des argiles. Altérations. Sédimentologie.* Masson ed., Paris.

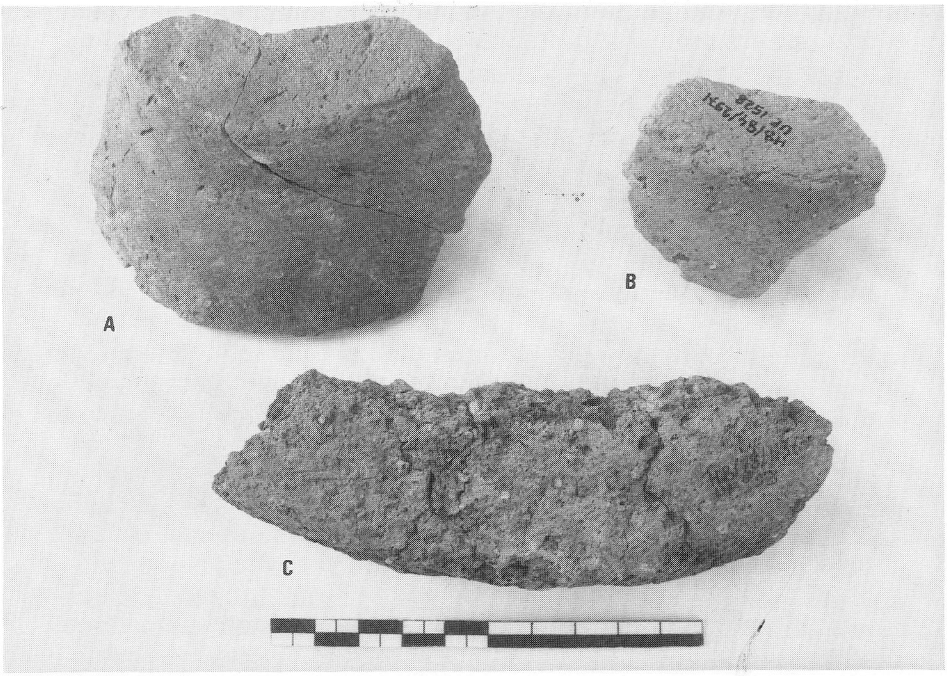
Montagu J. (1982) - *Les secrets de fabrication des céramiques antiques.* Montagu J. ed., Saint-Vallier-sur-Rhône.

Mynors H.S. (1982) - «An examination of Mesopotamian ceramics using petrographic

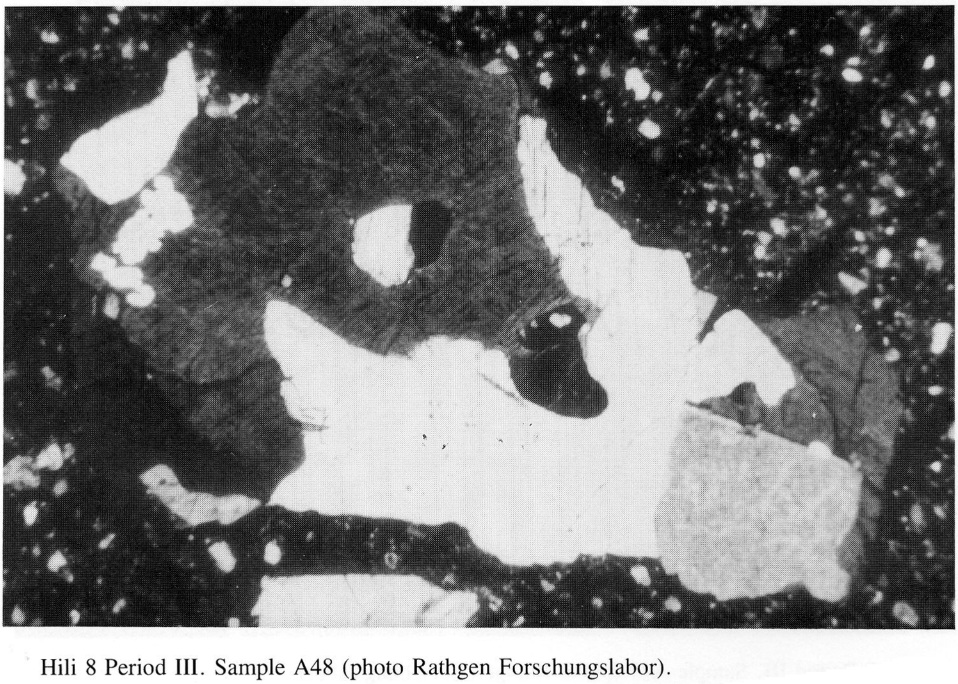
Hili 8 Period III. Coarse ware, macroscopic group 1 (photo S. Méry).



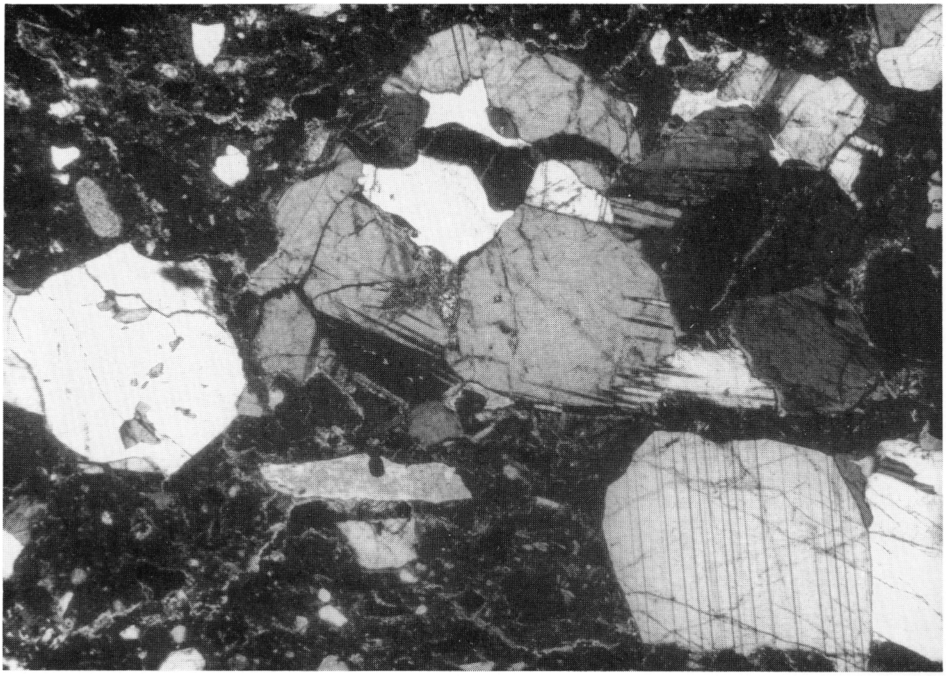
Hili 8 Period III. Sample A49 (photo Rathgen Forschungslabor).



Hili 8 Period III. Coarse were. A, B, macroscopic group 1. C: macroscopic group 2 (photo S. Méry).



Hili 8 Period III. Sample A48 (photo Rathgen Forschungslabor).



Maysar 25. Sample M 25-12 (photo Rathgen Forschungslabor).