observe without any stratigraphical discontinuity the changes in settlement patterns and material culture brought about by changes in economy.

The value of such an approach is to make one aware of the complexity of present-day societies and to assist modelling of what may, to some extent, have been a similar situation in the past. Such a picture is impossible to gain from the evidence recovered from most archaeological sites alone. Such real complexity has often been ignored either through lack of knowledge or for simplicity's sake, or again because it renders the interpretation of archaeological sites so much more difficult, but also so much more challenging.

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Roman inhabitants of the provinces, and thus they comprise a very varied well as Roman-style vessels. With time, such potters became quite proficient at using Roman technology. The resultant pottery is found in both Roman and indigenous contexts (e.g. Willems 1977). One suspects that technological changes co-occurred with organisational ones. North of the border, in 'free' Germany, the indigenous tradition persisted but also underwent changes. There was the beginning of specialisation, increased control over the raw materials used, increased standardisation of shapes, ever more different kinds of vessels, etc. (van der Leeuw, Shelton-Bunn and Spruyt, in press).

Clearly, the known data set is representative of complex changes. In this paper, I would like to focus on one (and, I think, a 'core') element among these: the changes occurring in the distribution and marketing of the pottery. Other aspects seem to fit together around this focus. Some of the relevant questions have already been summarised by Peacock (1982: 4):

1. To what extent was Roman pottery made in the home? (Or, in other words, what part of the total demand for pottery was satisfied entirely outside the market or exchange systems involved?)
2. How did the (production and) distribution systems of the more widely distributed fine wares differ from those of the utilitarian wares?
3. Under what economic circumstances can an industry based on primitive open firing (and more primitive methods of manufacture) co-exist with one based on a kiln (and more sophisticated manufacturing technology, such as the wheel)?
4. What are the ecological and economic conditions that determine where and how major industries develop? (Or, in other words, which variables are responsible for changes in the organisation of pottery manufacture and trading?)

Ceramic Research in Archaeology

In order to understand why the above questions have drawn relatively little research, and why some of this research has been rather ineffective, we must briefly consider the state of the art in ceramic research.

1. The natural sciences and ceramic engineering, which have concerned themselves with the properties of the raw materials involved, the transformations they have undergone during manufacture, and the technologies involved in achieving these transformations (in the past and in the present).
2. Experimental studies aimed at isolating the variables involved in specific (ancient) manufacturing methods.
3. Studies of excavated sherds which often show traces of the transformations they have undergone during manufacture, and/or which are spatially patterned in a way which is significant in reconstructing aspects of ancient exchange and trade in pottery.
4. The study of ethnographic data which involve non-factory-made ceramics, and which permit the observation of the manufacturing and distribution processes, and the use pattern which underlies these in a 'live' situation.

The first two of these areas of study have mainly contributed to our understanding of the technology of ancient pottery. They are the most advanced, but do not primarily concern us here (cf. Franken and Kalkstein 1975; van der Leeuw 1976; Rye 1981). The last two concern us more directly, and are more interesting, because less of their potential information value has been realised. The main problem seems to be, that a solid and coherent model from which to interpret these data and to account for the variables involved is lacking.
Such models should take non-physicochemical variables into account and are therefore difficult to design unless one has adequate ethnographic data at one's disposal. Peacock's recent study is the only one which attempts to generate such a model for pottery in the Roman world (1982). In an inspiring study, he uses a multitude of published ethnographic data from different areas of the world, and applies these to the major categories of Roman pottery.

But such published ethnographic data are generally not really adequate. Quite a few of the ethnographic studies of pottery have not been undertaken by ceramicists, so that often the technology is only partially understood, even if described to the best of the researcher's ability. Many studies, moreover, concern themselves with the simplest kinds of pottery, in simple contexts. In so far as they are applicable to the Roman situation, most of the studies comprise either country- or region-wide surveys (which are based on short visits to the manufacturing centres, which focus on production, and which have little or no time depth), or in-depth studies of one or two centres of production (so that there is no comparative coverage of larger areas, which would be essential to test distribution variables). Examples of the former are found in Rye and Evans (1975), Wulff (1965), Saraswathi and Behura (1984). Examples of the latter are Papousek (1982), Foster (1948), Lisse and Louis (1956), Centlivres (1971).

Much more promising are ethnoarchaeological studies, as they have generally been more aware of the kinds of problems involved, the questions asked and the data required by archaeologists. Individual studies have attempted to use ethnographic information concerning such variables as wear, life-expectancy (David 1972; DeBoer 1974) and breakage patterns, the value which decoration instils into pottery above and beyond its basic value as a household tool (Wobst 1977), etc. Others have studied demand-related questions such as the number of vessels in use at any one time in a household. On the other hand, spatial patterning should allow us to reconstruct patterns of trade, but such patterning has rarely been used to that effect in well-documented ethnographic studies. The fragmentation of effort is considerable; the studies are variable in quality and scope, and they are all qualitative. As far as I know, none are quantitative. We have no time-depth to our ethnographic studies, nor do we have any inkling of what causes change in pottery-making systems (Nicklin 1971). We have only very few adequate descriptions of the trade in pottery in the context of trade in other objects (e.g. Sahlin 1972; Allen, in press). What is needed is an in-depth study of a pottery-making tradition on a regional scale which includes the technological, the economic and the social aspects, and which focuses on manufacture, distribution and use from one and the same point of view.

Modern pottery manufacture and distribution: a pilot study on Negros, Philippines

A pilot study sheds, perhaps, some light on ways to answer some of the questions which were asked by Peacock, without pretending to answer them satisfactorily. The basic pottery tradition in the area chosen is one of hammer-and-anvil manufacture combined with coiling. It is practised in four different manufacturing situations. All these situations show different adaptations of the manufacturing technology and the trading and exchange organisation involved, as well as of a number of other (mainly social) aspects of life. Thus, it is possible to study in this region a number of different states of the same manufacturing and distribution system which in most situations occur one after the other with considerable time intervals. The temporal dimension may, as it were, be collapsed. In the spatial dimension it is at the same time possible to study the interaction, in an economic and organisational sense, of a number of pottery-making systems of different degrees of complexity: an interaction essentially similar to what went on along the border in Roman times. Last of all, the Negros case is strongly influenced by acculturation, through a rapid and forced adaptation to Western civilisation.

A brief sketch of the main traits of the four different manufacturing situations is in order.

A. Household Production:

| clay: | own rice paddy |
| temper: | none |
| tools: | turntable, knife, paddle-and-anvil, polishing pebble, water-bowl |
| technique: | hand-modelling on turntable; hammer-and-anvil |
| range: | six products |
| firing: | open-air, level ground, ca. 30 minutes |
| production: | batches of ca. 6-20 vessels once a month |
| time/batch: | five mornings plus final drying |
| market: | family and friends, barter; commercial production only to order |
| distribution: | potter or her sister, e.g. daughter |
| transportation: | foot |
| sex: | female |
| specialisation: | none |
| dependency: | none |
| part/full-time: | occasional |
| seasonality: | October-December |

B. Household Industry:

| clay: | bartered with owner at some distance |
| temper: | none |
| tools: | unpivoted mould (old pot upside down, coconut
Before we try to answer some of the questions posed, it may be useful to look at these data and note some striking and/or important facts. First, the data demonstrate that it is not necessarily the case that men take over potters when production is aimed at the market. In this specific situation, that may have to do with the Polynesian kinship structure and the consequent status of women in society.

The first major step-up in production is not so much achieved by the introduction of new technology, as by different scheduling of activities: larger batches are made at the same time, so that the time spent is more productive. This is corroborated by evidence from obsidian and flint industries (Torrence, pers. comm.).

It is questionable whether the next major increase in production is entirely one of technology either. An important aspect is the specialisation which occurs within the workshop, and the shedding of activities such as obtaining clay and marketing. Activities become better organised, more routinised as a result, while conflicts in scheduling inherent in the technology of the different parts of the manufacturing process are avoided by assigning specialists to each. Last of all, this enables the workshop to have activities run parallel in time. The end result is non-batch, continuous manufacture.

In another area, one sees changes in the pattern of dependencies. In the simplest situation, the potter is not dependent upon anyone, nor is she dependent upon her potting for her livelihood, but she works upon request. In more complex states of the system, the potter takes the production initiative. At the same time, she becomes more dependent on her potting for subsistence. The workers in a workshop become more and more dependent upon one another as they divide the work into specialised activities, instead of each doing all the work involved in making each pot. The system states increase in coherence, and although the initiative changes, so does the dependency between the workshop and the outside world.

In the Negros case, growth of the manufacturing system is related to growth of output in absolute numbers, as well as growth in diversity of products. Individual potters may, however, reduce the number of
different kinds of artefacts they make in order to compete better with the ones they are best at making.

Although not mentioned in the above overview of pottery making on Negros, there are various acculturation aspects to the situation. Thus, there is the ease of the potter who saw a film of potting on a kickwheel, made one himself (in the only all-male workshop found), but only uses it as a turntable. As to products, there are plenty of examples where the existing technology is used to make products which fit modern Western culture. The hand-made backings of electric hotplates are the most striking example. Modern technology may be used in the workshop, for example where cement is used to close cracks and paint the whole vessel, so that cracked third-choice water vessels may nevertheless be sold.

In the market, pottery now competes with plastics and aluminium vessels. Thus, the modern inventions are sold in town, to townsfolk who are familiar with them and who can afford to make the slightly higher but longer-term investment. The only other group of people among whom modern substitutes have become important are the most isolated mountain people. They reduce the risk of breaking vessels on their long trips up the mountain (all by foot) by investing in aluminium vessels. Clearly, acceptance of innovations is not only a question of communication!

Conclusion: Some Tentative Answers

In relation to the questions posed by Peacock, and presented above, there are some interesting conclusions to be drawn from the Negros material:

1. The extent to which pottery seems to be made in the home is, on Negros, directly related to the distance from the main centres of production. Under pressure from a major production centre, home production disappears rapidly, first in areas which are in better communication with the manufacturing centre, unless specific requirements (mountain living) create a more than normal demand. This is corroborated by evidence from colonial Virginia, where colonists used indigenous cooking pots. The home production of pottery finds an outlet outside the market system, through kinship or friendship channels. This should result in erratic patterns of distribution.

2. Some of the differences between more and less complex states of pottery-making systems are clear from the above presentation. What has not yet been stressed is that the larger the production of a workshop or manufacturing centre, the larger the batches which the potters trade with the middlemen. Essentially, it seems that there are qualitative differences between the distribution systems. The nature of these seems not so much determined by the nature of the pottery, as by the numbers of vessels to be distributed, and the distance over which distribution takes place. It might be worth finding out whether there are certain volume thresholds which require changes in organisation of the distribution system. One might find that these thresholds are related to distance and the capacity of the means of transportation. Hierarchy theory might be of some help (e.g. Pattee 1973).

3. It seems from the data at our disposal that there is not much difference in efficiency between kiln firing and open surface firing. Actually, the potters on Negros hold the quality of open-fired pots in higher esteem. They have begun to use the kiln only under pressure. Whether more complex system states may exist alongside less complex ones depends, it would seem, on a complex set of margins of efficiency, flexibility, dependency of the workshop on the external world, etc. These require more research and are only mentioned here because such research is badly needed. The simpler, part-time workshops per se are less vulnerable than the more highly organised ones (e.g. the second law of thermodynamics). The more complex workshops overcome this handicap only when they exceed the efficiency of the less complex ones by a certain margin. This efficiency gain is only achieved at the cost of a loss in flexibility. If that loss, in turn, exceeds certain margins, this makes the system more vulnerable to external disturbances. Here, then, the margin is between adaptability of the output to market circumstances on the one hand, and dependency of the potters on pottery making for their subsistence on the other.

4. It is noteworthy that changes in organisation and technology are not innovation-constrained. In an interactive situation like this one, that would mean that all innovations would be used everywhere. They are related to demand, but demand is also constrained by offer. An 'external' explanation will not do, not even 'population growth'. It has been argued elsewhere that growth in interactivity and information-flow and information-processing capacity is the core mechanism (van der Leeuw 1981). As interactivity grows, so does dependency of each subsystem on the next. As we have seen, this causes the margins to narrow and the productivity to grow. Such growth is only achieved by changes in organisation and technology. On the other hand, this growth in turn increases the dependency of the subsystem and its components on each other and the system at large, narrowing the margins even further. Output needs to grow, so demand needs to grow. Population growth, growth of the interactive group and diversification of products, but also aggressive marketing, promote this. It is this, truly vicious, circle which leads to collapse, but also to increasing poverty and misery for the potters. In our case, in the nucleated village industry, they work during lunch in order to keep up their quota. The middlemen have them completely in their grasp.

This paper has presented issues, data and conclusions in a much abbreviated format, which does not do justice to any of them, least of all to the potters themselves or the literature involved. I do hope that, nevertheless, it may contribute some thoughts for further discussion, and show how ethnoarchaeology has a very fundamental contribution to make to archaeology and anthropology. A more encompassing presentation of the data and the research design which might lead to collection
of data which are relevant to the questions asked here is in press (van der Leeuw, in press).

Acknowledgements

The author would like to acknowledge the financial support of the Netherlands Organisation for the Advancement of Pure Research (Z.W.O.) and the hospitality and friendship, as well as support, of the Bais Archaeological Project of the University of Michigan, Ann Arbor, and its Director, Professor K. Hutterer.

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