# 3. THEORY AND REALITY IN PALAEOECONOMY: SOME WORDS OF ENCOURAGMENT TO THE ARCHAEOLOGIST

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## Preface

When I came to the conference on 'Economic Archaeology' I was more than a little taken aback by the desire of most of those present to want to talk about 'Social Archaeology' instead. I suppose I really should not have been so surprised, for British Theoretical Archaeology (or more accurately in this context, Cambridge-centred Theoretical Archaeology!) is at the moment passing from an early (Archaic?/Classic?) mini-paradigm of Renfrewsian 'Social Archaeology' (Renfrew 1973), to a mature (Classic?/Decadent?) mini-paradigm still based on social anthropology but on more recent research concerns — as, 'Structuralist Archaeology'. The idea of holding a conference on the 'Economic Subsystem' was perhaps something of a 'Retrospective' for the once dominant Cambridge Palaeoeconomy School (Higgs 1972, 1975), which represented the key mini-paradigm (at Cambridge!) in the early '70s. Personally, I have begun to feel a little 'jet-lagged' from the rapidity of these shifts of emphasis, since they tend to leave a trail of shivering and only half-washed babies behind them. It was surely the greatest promise held out, again at Cambridge, by our much-lamented David Clarke, in his later writings, that he was showing us the way to reconcile hitherto competing research orientations into a coherent but pluralistic research universe, in which the main advantages of each research group were stressed and acknowledged by practioners within groups belonging to different spheres of interest. We are clearly as far away as ever from recognising in ourselves the lessons of 'Critical Self-Consciousness' (Clarke 1973).

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## Optimism

All too often archaeology students' essays end as follows: "In conclusion, we really know almost nothing about this subject, and must wait for the results of future, more careful, research"; many of those who teach archaeology, and quite a few of those attending this conference will also wish to decry our feeble state of knowledge concerning Economic Archaeology. Yet it seems to me that we deserve to be thoroughly optimistic about just how much we do know, and about the way modern archaeology is leaping forward in its skill of recovering and interpreting data relevant to this topic. Arguably the subject is in a healthy and rapidly advancing state, not the confused hag some would portray.

In offering these words of encouragement I would like to examine some current approaches to economic prehistory, moving up the pyramid of economic activity: starting at the broad base, the production, consumption and utilisation of local foodstuffs and raw materials in a subsistence context; then up to the level of regional internal exchange and redistribution; finally to the level of inter-regional exchange and professional marketing. My main emphasis however will be on subsistence and the all-important interaction between that and exchange systems.

## The Subsistence Economy

### Landscape Reconstruction:

With subsistence activity, a satisfactory analysis of palaeoeconomy demands a reasonable fit between the body of current theory, a set of controls of an analogue nature, and the recoverable archaeological data i.e. the 'palaeoreality'. Fundamental also, and seriously neglected by the Cambridge Palaeoeconomy School in the post-Godwin and early Higgs years, is a proper awareness of the need to reconstruct the landscape contemporary to the sites being analysed. We have in fact come a long way from Cyril Fox with his simple plotting of distributions against an assumed landscape (cf. Figure 59 and pp. 135-137, in Evans 1975), and this first hurdle to palaeoeconomy is well on the way to being universally conquered with a battery of techniques from Quaternary Science, including a blanket of pollen analyses (cf. for example Spratt and Simmons 1976), landsnail and insect studies (cf. for example Figure 22.2 in Bowen 1978), and areal geomorphology (cf. for example Bintliff 1976).

### Land Potential:

Given the contemporary landscape, can we evaluate its potential for palaeoeconomy? Allowing for changing crop and herd yields and suspected technological competence, it is possible to map potential land utilisation for various types of economy: this has generally been done for mixed farming economies (cf. the soil map and land potential map for the Ayiofarango Valley, Crete in Blackman, Branigan et al., 1977). Such a map could be converted for basically pastoral or hunter/gatherer economies, and for the latter we might consider in this respect the stimulating studies of Grahame Clark (1972), Paul Mellars (1975), David Clarke (1977), and Jochim (1976). Besides foodstuffs the same mapping can be done, for example, for chert, building stone, copper resources (cf. Sherratt 1977, Figures 9, 10 and 15).

### Maximal and Empirical Extraction Rates:

Valid criticisms have been levelled at the equation of potential economy with a practised palaeoeconomy, with its assumption of a maximising approach, or the lesser sin of using selected empirical ethnohistoric analogues without any underlying general theory of Carrying versus Carried Capacity (cf. for example Clarke 1972, Thomas 1972, with the discussion by Hassan and Glassow in Schiffer 1978). But such models are invaluable heuristic devices to demonstrate the range of possible exploitative strategies and extractive potential within which the actual economic strategy was selected. Nonetheless the significance of selection amongst alternatives, and the realisation that it is

exceedingly rare to find practised economies from ethnohistory that regularly approach anything near their regional carrying capacity, have created a demand for more sophisticated treatment of the data.

Approximate Extraction Rate and Strategies Actually Selected:

What can be done is all very well in theory, the economic potential, but how can we investigate the economic behaviour of subsistence communities actually in operation in a landscape for a given period? (i) Direct information can be obtained from studying the distribution of settlement and activity areas. We find for example suggestions of contrasted locations for early hominid strains in the different micro-environments around Lake Rudolf, or the distinct locational emphases shown by our neolithic and early bronze age sites as opposed to our later bronze age sites in Southern England (cf. Barrett 1976: 297-299) — reflecting a major shift in the economic importance of certain soils. However, such plausible spatial interpretations, even where reinforced by the application of techniques such as Catchment Analysis and other locational devices (see below), must receive adequate backup from (ii) Excavation to confirm the nature of foodstuff and raw material extraction from the landscape. Thanks to the probing and illuminating papers of Payne (1972 a, b) and Dennell (1972, 1974 a, b, 1976), however, we are now all very much aware of the severe problems in trying to reconstruct a site economy via floral and faunal samples from its partial excavation. The relevance of recent advances in archaeological sampling theory to combat these difficulties is underlined in important contributions by Cherry and Gamble to the Sampling in British Archaeology volume (Cherry et al., 1978). (iii) Increasingly the two former approaches can be supplemented by landscape sampling analysis — indications from the site catchment area of distinct Man/landscape interactions (cf. the mosaic of arable and pasture indicators for earlier bronze age Wiltshire in Bradley, 1978, Figures 6-7, or the excellent land use analyses spanning many periods on the island of Sylt in Kossack et al., 1974). Closely associated with such evidence, for much of later prehistory, is that obtained from the mapping and dating of field systems; the results of which have revolutionised landscape archaeology over much of Northwest Europe. An excellent example of the fruitful matching of settlement and monument distributions to changing field systems is provided by the Rams Hill publication (Bradley et al., 1975), and the wider implications are seen in the recent CBA Lowland Zone volume (Limbrey and Evans 1978) and, for the Continent, the work of Brongers (1976) and a number of Scandinavian scholars (cf. Kristiansen et al., 1978).

Catchment analysis:

But in particular, especially where hitherto land use behaviour has not been detected, fossilised, as in 'iii', we must also consistently apply what I still believe to be the most useful locational tool derived by archaeology from human geography: Site Catchment Analysis. Let me comment that after accomplishing around 300 studies using a variant of the technique, many of which offered modern settlement and land use control, I find its main principles virtually faultless. Namely that something like 99% of sites, by virtue of the Least Effort principle, dominate resources of radially decreasing value to their inferred or known chief exploitative activities; that within almost all

cases, resources that offer primary life support for a community lie within limited radius of it; that the catchment diagram for a site, with practical allowance for landscape change, provides a highly reliable mirror for its former occupants' subsistence and surplus production priorities, that can also prove highly consistent examined together with a series from sites of the same cultural background. The repetitiveness of site catchment results is one of the most striking features of regional applications of the method (cf. for example the Romanellian in Southern Italy in Jarman 1972, Figure 18.5; or the Mt. Carmel coastal plain series in Vita-Finzi et al., 1970). Or to take a more chronologically dynamic view, note the highly informative contrast between early Neolithic land choosiness and the push into marginal lands by the later neolithic in Central Europe (Figures 3-4 in Jarman et al., 1977). Consider the stimulating achievement of Ellison and Harriss (1972) in being able to generalise typical catchments for sites in Southern England from bronze age to Saxon times. Then turn to that admirable analysis of the Tell Gezer catchment in Israel, where Webley (1972) modified the land potential over time to mirror the effect of changes inferred in agricultural technology, successfully matching implied food support (on empirical extraction rating) to indications of population density for the late prehistoric town.

In my own ongoing research, the difficulty in using the 'classic' one and two hour thresholds, designed as maxima for single sites, when the district settlement pattern of arguably contemporary sites suggests more variable, and usually smaller, territories, has been met by applying Thiessen polygon analysis in tandem with a catchment study of the resultant implied territorial cells (cf. Bintliff 1977a, Appx. A and work in preparation). This recent work allows one to recognise a class of asymmetric catchments where the site territory is well within any threshold to intensive exploitative activity out from the home base. The interplay of Thiessen and Catchment analyses offers invaluable insights, such as the possible recognition of common land modules for mixed farming settlements of comparable size. I should like to leave the discussion of the relationship between these cells of theoretical land use, and the dynamic picture of changing intensity of use of each cell (raised challengingly by Flannery 1976, Ch. 4), for a lengthy treatment I am preparing for publication in the near future, but it does not affect our growing appreciation of conceptual 'modules' of territory that seem to form a framework within which extractive variety occurs over time.[1]

We are, then, now approaching a position where we can produce period by period mapping of land exploitation, district by district, on a qualitative, pie-chart priority list basis, for fruitful comparison with historical data (such as, for example, the Kent abbey records reproduced in Derby 1976, Figure 36). In summary, the techniques discussed hitherto offer a guide to priorities and dominant strategies for local extractive economies in a subsistence context. With the site faunal and floral data we are regrettably still in the sphere of qualitative measurements (and the same is true for raw material), whilst in the wider landscape around the site it is only with field evidence of type 'iii' that we can begin to suggest in a semi-quantitative form the degree of 'cropping' of the land potential.

Intensity of Exploitation:

So we are still some distance from a definitive mode of analysis to tackle the relationship between theoretical carrying capacity for a district, the actual population cover at period X, and its extraction rate and selection strategy for resources. How do we progress from here? Firstly, we can calculate as indicated earlier, the theoretical carrying capacities with varied economic strategies, allowing a range for factors such as length of fallow, etc.; hopefully we might be able to narrow down the actual strategies and priorities from excavation data and locational studies. Secondly we can use the best available estimates of settlement numbers and size to suggest the order of population who might actually have been locally maintained.

A simple comparison of both indices could be an adequate guide to intensity of foodstuff exploitation, if we were convinced of (and hence allowed for) but a minority of foodstuffs being imported into the district or exported for raw materials etc. Thus, for example, for a well-surveyed valley in Crete, my estimates of bronze age population on a mixed farming strategy, a sensible fallow, and a due respect for the tolerance of the poorer soils, produced 70-140 people, allowing surplus olive oil for obtaining metal and 'taxes'. In terms of carrying capacity maxima, this would be perhaps 50-75% of total valley capacity under a maximisation strategy. This figure compared well to the bronze age settlement evidence, the later historical population totals, and with predicted population from a series of dated communal tombs lining the valley (Blackman, Branigan et al., 1977). To take another example: in the Plain of Troy, in the absence of detailed site survey, only prominent tell mounds are recorded, possibly local centres such as Troy itself. Theoretical carrying capacity for the region, allowing for landscape and technological change, is strikingly similar to recent population cover, but the limited area of the tell sites suggests either a prehistoric population living remarkably below capacity, or else the existence of a dense pattern of lowly farmstead sites awaiting survey discovery. Considering the partial field walking undertaken over the last 100 years, and despite the élite nature of the Troy community for much of its life, I suspect the truth to lie more towards the former explanation. But the importance of such competing views is that they are testable in the Troy region via a short-term survey programme with strong geomorphogical expertise (Bintliffe, forthcoming). I would also cite again, for a final illustration, the fine Tell Gezer study and its population/resources analysis. In Britain the current emphasis on sites in their landscape and as integral parts of patterned site distributions is already encouraging similar calculations; reflect for example on the wealth of data emerging for the iron age and Romano-British landscape in regional projects such as that in the Nene Valley. On a much vaster scale, the whole of Pharaonic Egypt has been the object of Karl Butzer's estimates of population cover, combining land use data, landscape change research, technological innovation and plentiful historical sources (Butzer 1976).

The use of real-world analogues as in the study of Jochim (1976) and examples of my own work noted above, allows an essential corrective to any simple assumptions of maximisation to carrying capacity limits. Apparent 'under-exploitation' may be the result of a sensible recognition of the need

for adequate long-term safety margins, rather than 'stagnation' or 'incompetence'. The feedback from carrying capacity estimates, to actual estimates of population density from archaeological survey, offers a suggestive rating of the cultures concerned in terms of the degree of such a 'safety-margin', and hence by implication the degree of 'stress' on the land potential. Our next goal in this area of research, is then to construct some general theoretical models on as wide a range as possible of ethnohistoric examples, for generalising on the links between settlement density/land potential/extraction rate and strategy, especially as regards the long and short term effects of varying these elements in respect to each other. To give an example of the future potential of such an approach, I offer some preliminary analyses from my current research on the development of population on the Greek Mainland. Recent ethnographic studies have suggested that a frequent rate of actual to potential carrying capacity for farming populations lies somewhere around 30-40% of potential. Given the recurrent difficulties with the climate in the Mediterranean, allied to fluctuations in crop/herd health and cultural factors, let us take the lower figure as a securely viable long term population/land extraction ratio to total capacity. I am at present studying data for rural densities in Classical Greece, that would in these terms suggest a dangerously high population, placing the landscape and contemporary communities under considerable 'stress'.[2] A similar, but less dramatic push of population well beyond our level of a 'safety-margin' extraction/population ratio, may be demonstrable for Mycenaean rural densities. In neither case, and this is highly significant, do I consider a major part of supportive foodstuffs to have been imported, so as to relieve such densities. The virtual depopulation of the rural landscape in the periods following Mycenaean and Classical times, indicated hitherto on available data, might now be suggested, controversially, as a predictable consequence of the observed pressures; were these marginal situations merely precipitated by internal or external conflict? A complementary line of research to test such an hypothesis might be to subject associated burial populations to the kind of dietary analysis so stimulatingly discussed for the Maya civilisation by Rathje (1969).

The Non-Subsistence Sector

In the studies cited and suggestions offered hitherto, it must be admitted that calculations assume a reasonable match of available resources, technology, local population density and local extraction rate — even if the extraction rate is estimated via analogue controls and internal feedback from the sources noted (settlement evidence, etc.). Our next crucial difficulty is to balance any calculations thus far obtained for the relationship between local resources and local population, against the estimates for additional extractive activity undertaken for inter/intraregional exchange and the support of regional specialists and administrators.

One conceivably effective approach to this problem is to try and trace surplus production to its goal. In the case of food, it is quite possible to estimate the population at central places such as bronze age palaces; rather more difficult but feasible to estimate the approximate proportion not significantly food-producing (here a careful comparison of activity and residence data from excavations with historical analogues would be instructive); we are then left

with a figure for required regional foodstuff support. A study of the storage capacity of the Minoan palace of Mallia, by French scholars (Van Effenterre et al., 1963), has already been able to suggest the necessary regional catchment required to fill these presumably hierarchically redistributed stocks. But this approach is limited to smallscale, highly regionally introverted systems where we have reason to 'delimit' the flow of food and raw material chains to geographical 'boxes' amenable to the techniques discussed earlier.

Secondly, we can attempt to quantify the circulation within a region of internally and/or externally exchanged raw materials, probably as a generalisation from a parameterised sample of finds at a spectrum of sites across the settlement hierarchy; then the corresponding surplus implied for local foodstuffs or local raw material will provide two obvious theoretical equivalences to investigate. The documentation of raw material distribution is now highly advanced and one of the most significant breakthroughs in economic archaeology (and particularly flourishing at my own department of Archaeological Sciences at Bradford!). Vital to the isolation of raw material and finished artefact exchange are techniques of physical analysis such as neutron activation, X-ray fluorescence, ceramic petrology. Archaeological landscapes, once dotted with exchange networks defined on intuitive typological similarities, can now be reanalysed and checked with the sophistication of archaeological science (strikingly successful examples being the obsidian 'trade', cf. Hallam et al., 1976, or the tracing of Late Saxon pottery products from individual kilns, cf. Ipson in prep.). The matching of artefact distribution patterns to distinct modes of exchange and servicing have been fruitfully explored by Ian Hodder (Hodder and Orton 1976). Especially interesting in his British work is the suggestion of continuities of 'servicing catchments' (cf. op.cit., Figure 4.20).

The reciprocal movement of foodstuffs in exchange for raw material is an exceedingly difficult task to trace in average conditions of archaeological preservation, but such activity should have been commonplace in most developed societies. If we turn to mutual exchange of foodstuffs, between subregions or whole regions, survival and recovery limitations in most archaeological environments cause formidable problems of detection. We may hope to identify for a chosen region of study the final result of intra and inter-regional movement of foodstuffs and raw material, from an analysis of the settlement data, from the study of the proportions of semi- or non-food-producing strata in the population, and via estimates of the level of supply and consumption of local and foreign raw materials. For identifying the relative weighting to be assigned to possible imported foodstuffs, locational analysis cannot normally offer sufficient quantitative information for the local contribution, as we have seen, unless we are fortunate enough to possess detailed land use evidence within the local catchments concerned. We might look forward (optimistically) to a time when site faunal and floral study will be refined enough to offer realistic weightings for food sources, sufficient to pinpoint a significant consumption of certain species considered to be imported (on grounds such as environmental constraints, or catchment/land use indications); or for the same reasons, the reverse, the export from a site of locally produced foodstuffs or herd by-products. It is exceedingly rare that we can spot the products conveyed in such transactions, and usually this is from surrogate evidence, for example closed pot shapes in Mycenaean pottery exported to the Levant that

may have contained olive oil. Again then we stand at one of the major research barriers in palaeoeconomy, — but surely this is, for future ranks of research students, a stimulant rather than a depressant!

However, as I shall demonstrate at length in a forthcoming publication, any tendency amongst contemporary archaeologists to stress inter-regional exchange of foodstuffs (or indeed other raw materials) as a dominant and central factor in the dynamics of the typical prehistoric economy, is entirely anachronistic, and a misconception of the nature and functioning of prehistoric communities. I shall be presenting detailed arguments to support the following crucial propositions regarding prehistoric food production:

(i) In the vast majority of such societies, exchangeable or 'marketable' or redistributable foodstuffs constitute no more than a small proportion of total food extracted from the environment, which is predominantly consumed by the primary producers.

(ii) In the vast majority of such societies, this non-subsistence foodstuff element is predominantly consumed regionally, not inter-regionally, and almost entirely within the confines of smallscale sociopolitical systems and geographical regions, analysable with the techniques discussed earlier.

(iii) The demand for, and consumption of, raw materials necessarily imported into such societies is, in the vast majority of cases, never crucial enough to create a shift in the balance of local food production from a predominant orientation towards subsistence followed by a support role for regional specialists (cf. propositions 'i' and 'ii').

These key propositions allow, as you will note, for a significant minority of exceptions, represented by ports of trade, copper and salt-mining communities, etc. But allowing for this minority, we reach some far-reaching corallaries:

(A) The average prehistoric settlement can be expected to be primarily extracting foodstuffs and other raw material from its local environment for its own support. It is therefore decidedly liable to conform to the constraints of Least Effort and the Land Rent, in other words will be highly amenable to inferences drawn from its study by Catchment and other means of Locational Analysis.

(B) For prehistoric societies, the regional settlement system, is, with rare exceptions, the most significant unit for analysis regarding the production and consumption of exchangeable foodstuffs and most other raw materials. Such a smallscale system is very suitable for analysis of the subsistence/non-subsistence balance with the approaches outlined earlier.

(C) If we consider food production in a regional population, it is highly plausible that striking alterations in the balance of primary productive sector versus semi- or non-productive strata — such as are associated frequently with the growth and decline of higher cultures and primary civilisations, stem most often from internal re-organisation of basically introverted regional systems of production and consumption. My

current working hypothesis is that this is to be related to fluctuations in the local extraction rate, and the ratio of actual to potential carrying-capacity. Similarly, the running-down or collapse of complex regional systems of this type, can I suggest most often be explained by investigating the negative consequences of this local re-organisation process.

Such an argument also has implications, with naturally rather less force, for much larger-scale cultural systems of historic times. My own field experience suggests that where there is a castle, an abbey, a palace, a market centre, — in other words a nucleus for exploitation, control and servicing of lower levels in a settlement hierarchy, there will also be, with rare exceptions, the human raw material — i.e. a local concentration of people who are primary producers of foodstuffs (and still to a major extent for their own subsistence). And as previously argued, it is from the careful study of this hierarchy of settlements and their catchments, their accompanying imports, that the overall balance of subsistence against exchange and redistribution may be analysed.

Thus, we are always aware that Roman villas were an intricate part of an economy with a strong market sector, and could sometimes arise as a 'rural retreat' for the wealthier urban population. Yet a balance had usually to be sought between production for the regional and even inter-regional market, a pleasing view and good access to the road network, and the constraints and opportunities imposed by the physical landscape, coupled to the desirability of providing the immediate subsistence support of staff and villa owners for a cross-section of foodstuffs and raw materials. The network of Late Roman villas in the Chilterns (Bintliff, in preparation) is surely then suitable for an analysis of this subsistence/exchange interface which would involve Catchment Analysis and other locational approaches, carrying capacity study, the evaluation of excavated environmental data, estimates of villa population and of imported raw material requirements. On our Corollary 'B', most of the non-subsistence sector of production should be amenable to study and identification in terms of the immediate regional archaeology (and in this instance attention would naturally concentrate on the supportive requirements of the regional service centre of Verulamium). The calculations involved may fruitfully be compared to tangible investment in villa furnishings, and at least in some cases suspected territorial fertility seems to correspond to the degree of impressiveness of the villa complex. With greater documentary support available, one could begin to investigate the same interface for medieval peasant communities. There are even some instances where the medieval parish network seems to mirror that of villas in the same district (cf. Fowler 1976, Fig. 1.9), almost a laboratory situation for isolating the nature and degree of change between the ancient and medieval rural economy. Would you be surprised to learn that Bradford archaeology students have been practising Catchment Analysis on medieval villages all over Britain with highly successful results?

The Hodder/Frere controversy (cf. their contributions in Rodwell and Rowley 1975) as to whether the lesser walled towns of Roman Britain were patterned according to military or marketing considerations, — indeed the whole debate about regional centres and their locational priorities, — obscures the underlying rationale to both regional control and servicing: in

most such cases there must exist a local concentration of population to be controlled or serviced, and a priori the subsistence wherewithal on which that population and indeed the regional centre are founded and maintained. An illustration of the same principle can be seen with the Saxon network of fortified townships or 'burhs' (cf. Biddle 1976, Fig. 3.3). Almost every farm of Alfred's kingdom was within a day's walk (30 km) of two such refuges from the Danes, in which sense they are strategic foundations. But at the same time, if we exclude the poorer and marginal lands of the kingdom with their arguably low population, the rural communities of the remaining, high population density lands of that kingdom lay within a day return of a burh (15 km), as a possible local centre for marketing and general servicing. Hence the later development (and sometimes prior existence) of many burhs as typical market towns.

Even specialist trading centres can generally be shown to hinge upon an adjacent hinterland of dense local population, and the latter in turn upon concentrations of local agricultural resources (far less frequently on local raw materials). Hengistbury Head, for example (cf. Cunliffe 1977, Fig. 7) a suspected iron age community of this class, is axial to the territories of two densely-farmed and settled tribal hinterlands.

I have tried in this paper to present what I see to be the current state of play in field applications of palaeoeconomy, with the emphasis on prehistory, but with some comments on historic archaeology. Difficulties and barriers to analysis and interpretation do indeed abound, but I hope I have suggested some promising approaches for scaling these obstacles. Provocatively I have proposed that some of the most prominent fences can be admired from a distance, then merely circumvented on well-made tracks, without loss of insight.

Footnotes

1. Objections are commonly raised to the use of Catchment Analysis (CA). The more vociferous critics tend to be scholars with little or no experience of fieldwork and the interaction of modern and ancient settlements with their environmental setting. Their objections are therefore theoretical, and are of the nature of "Surely it is too deterministic", or "How can we ever know that the land was used exactly as you suggest?". More substantive comments might have been expected from that supposed compendium of Man-Landscape research techniques for archaeologists: Hodder and Orton's 'Spatial Analysis in Archaeology' (1976). However, whilst I admire the battery of techniques eclectically assembled from modern Human Geography, and find the modelling of artefact exchange (see p. 41) illuminating and relevant, I find the tome as a whole conjuring up a vision of the archetypical armchair scholar, — this time with very smallscale maps, a collection of symbols and a calculator. The landscape seems to be featureless, isotropic, and the societies from the first assumed to be best approached via models and techniques developed from 20th century industrial landscapes. We search almost in vain for any inkling of understanding of the nature of pre-Industrial economies and their characteristic settlement patterns, tied so closely as they were

to the production of foodstuffs. The massive literature that geographers have assembled relating to the links between human geography and physical relief, geomorphology and pedology, vegetational zones, etc.—all is ignored in favour of maps in which at the most the sea and major rivers are allowed some effect on distributions of sites and finds.

The brief discussion of Catchment Analysis appears near the end of the book, appropriately as a kind of afterthought, and the technique is rather superficially dismissed; largely on theoretical grounds, but there is some concession to empirical evidence questioning its validity. We read, rather cryptically, that African societies exist where the villages are surrounded by very poor land, thereby disproving the idea of a decline in human agricultural input with distance from home base. Are you content with this argument? I must confess that for a long while I noted this fact as a cautionary tale, suspending my critical faculties. But really we should ask how this contradictory state of affairs arose. Even if we accept that these villages lie amid the poorest land, I would like to know the reason, be it merely caprice, or due to some compulsion emanating from the pressing demands of native structuralist principles, — thus reversing what would seem to us to be economic common sense. So I went, not only to the short paper raising these issues (Jackson 1972), but to the most important of the primary sources for such situations, Pelissier's Les Paysans de Senegal (1966). It is from the latter that we discover the following: these villages were originally located in good agricultural situations, in woodland with reasonable soils. Cultivation took place on an Infield/Outfield basis. The Infield was cultivated on a short fallow, and was naturally the land innermost to the village. The Outfield was in the woodland and scrub beyond, and consisted of temporary clearance plots for shifting cultivation, with prolonged fallow intervals, together with grazing zones. The more concentrated effort on the Infield led to its deterioration, lacking the woodland recovery episodes. However the underlying potential of the soil, and a low but significant degree of manuring due to the passage of stock into the Outfield, allows the Infield to continue in short fallow cultivation for many of these communities. Where the soil is unable to cope, and permanent loss of fertility arises due to processes that are irreversible such as laterisation, the community will regularly shift its base to begin the cycle all over again.

Given all the facts, it seems to me that these communities should be considered as offering supporting, rather than conflicting, evidence for the principles of Catchment Analysis. The land nearest the home base is more intensively used than that further out; permanent decline in the Infield, despite a great and continuing land potential in the Outfield, prompts relocation of the community to a more fertile position for the Infield.

Much more serious criticism can be found in a reasonably balanced review of Catchment Analysis by Donna Roper (1979). The key difficulties that arise from that discussion seem to be as follows:

(a) With so few empirical values for the limit of the catchment, from ethnography and history, the size of a site territory is an initial stumbling-block before territorial content can be evaluated accurately.

Roper indicates that many recent applications of CA advocate preliminary definition of territory from the analysis of the contemporary settlement pattern surrounding the site under study, using Thiessen polygons or similar approaches. This is a development I have also, and independently arrived at (see p. 38). One might now proceed to modify, if desirable, the 'equality principle' underpinning Thiessen analysis, using some variant of weighting (e.g. gravity models) based on relative site size or inferred/known site function.

(b) If sites are assumed to have been located in order to control key resources, then there should be a correlation between resource potential and the importance of a site in the regional settlement hierarchy.

This postulate is not part of the original theory of CA, and it is not surprising that its success in testable situations is rather variable. It is most important to recall that the primary papers on CA by Higgs et al., argued that most sites in less complex societies should be rewardingly investigated by CA. It is expected that sites will be found where the predicted fit between catchment and site type is clearly unsatisfactory, and this should stimulate specific research into the particular nature of site occupation, the possible relationships with other sites and so on. CA does however assume that most sites are in fact sufficiently dependent on local foodstuff availability to reflect the disposition of notable quantities of such resources in their reconstructed catchments. As far as I am aware, this postulate has not been refuted, and indeed my data and that of most active field palaeoeconomists consistently supports it. The flexibility of this approach is appropriate to the empirical patterns that seem to be emerging, as we can see e.g. from Peebles' application of CA to settlement patterns of the Moundville phase in the southern States (1978). Small and very large sites show a good correlation with land potential, but middle range sites fit less satisfactorily. One might suggest here that the basic unit of settlement, the village, is located according to local support availability in primary foodstuffs, i.e. its status is reflected in its chosen catchment. The largest sites, district centres, may owe part of their original impetus to unusually rich localised resources, and even when dependent on outside support at a mature stage of development, such immediately accessible resources should act as a buffer against minor shortfalls in outside contributions to the economy. Middle range sites, minor centres, possibly act as foci for groups of villages, and their rise may be due less to their own catchment potential than to the demand for service-centres at an intermediate level in range of functions and in terms of accessibility.

In conclusion, it is often necessary to remind those who do not practise Catchment Analysis, that deviations from expectation are both included in the general theory underlying the technique, and are indeed a fruitful source of contrast to the more common experience of expectation fulfilment. Sites where the population seems to outstrip local resources, encourages us to investigate the role of extra-catchment interactions, or the possibility of short-lived hyper-exploitation. On the other hand, we might find the reverse, rich catchment resources but a 'misfit' minor

site; here we are being stimulated to investigate models such as a 'pioneer' situation, implying an early and perhaps truncated development of exploitation.

With such examples, the role of micro-environmental studies in recovering actual land use palimpsests, and of artefact analysis for exchange studies, will be of crucial assistance.

2. Apart from my own earlier research, some of this data stems from the collected endeavours of the Boeotia Survey, under the joint directorship of myself and Anthony Snodgrass of Cambridge University.

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