

The role of ge archaeology in extending our perspective

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Abstract: Specialists and the general public alike are very aware of human impacts on our environment. Climate change, deforestation, desertification, soil erosion and other topics are currently much in the news, but human influence on the environment is not a new phenomenon. Geoarchaeologists study the traces of human interactions with the geosphere dating back to ancient times, as well as up to and in the present. Geoarchaeological investigations provide the key to recognizing landscape and environmental change within a region, as well as reconstructing ancient landscapes and palaeoclimatic regimes. Such an interdisciplinary approach makes it possible to interpret the ways that humans affect the geosphere, through such things as subsistence and resource exploitation activities, settlement location, and local and regional land-use patterns. This approach also allows us to determine the effects of environmental change on human societies. For millennia, humans have been coping with, or provoking, environmental change. We have exploited, extracted, over-used but also in many cases nurtured the resources that the geosphere offers. In the geoarchaeological perspective, human life has never been separate from nature. Geoarchaeology can thus provide a more inclusive and longer-term view of human–geosphere interactions, and serve as a valuable aid to those who try to determine sustainable policies for the future.

The world seems to be changing: the weather is messed up, climate is different, sea level is rising, glaciers are melting, new plants and animals are showing up in places where they never used to be ... A lot of people are worried. They feel as if we are in uncharted waters. For many people, there is an underlying assumption that the environment is 'supposed to be' stable. The mere fact of it changing is frightening. They feel that we have never had to deal with such changes before, and they do not know how we will be able to handle it.

This perspective is understandable, as what most people know of the world is based on their own experiences, with a smattering of history tacked on. Our own experiences are naturally very limited, no more than one lifetime (plus what our parents and grandparents tell us). The perspective that history can provide is not much better. History, which depends on written documents, is in fact very short: at best no more than a few thousand years, and most of that very sketchy. For the most part we have only a few snippets of information about any one time, not an overall view. In addition, if we want to learn about the environment, historical documents tend to focus on the wrong details. They tell us about kings and wars and trade amounts, and they give us only the part of the story that one small subset of participants wanted to tell. We have to work hard to extract information about the environment from such sources.

History also has the drawback of having taken place during relatively recent times, when climate

was in fact fairly stable. The little information that it does give us is, therefore, misleading when it comes to understanding the real behaviour of the environment. As geologists and archaeologists know, climate and the environment are anything but stable: change is the real constant. So although historians can tell us that during the Little Ice Age glaciers in the Alps advanced many kilometres down valley, and that during the preceding, warmer, period the Romans grew grapes and made wine in Britain, what they cannot tell us is that even those changes were minor, compared with what went on in prehistoric times.

Archaeology extends our knowledge of human activities back through time, well beyond the limits of history. It uses the physical traces of those activities to reconstruct past behaviours and cultures. However, although archaeologists are generally well aware of the need to place their finds in an environmental context, their main focus is culture and culture change, not environment and environmental change. Geology on the other hand studies the planet Earth, and therefore tells us how climate and environments have changed through time, but not how those changes have affected people nor how people have reacted to them. Geoarchaeology bridges the gap, and studies human behaviour in its dynamic environmental context, over the full time range of the existence of human beings. It shows us that we have, in fact, lived through many major climatic and environmental changes, some of them very rapid. We have caused

some of them, we have exploited some of them, and we have suffered from some of them. Yes, we should be concerned about our current situation, but we have faced instability before. Geoarchaeological case studies, such as those in this book, show us that we can survive, as long as we are willing to adapt.

What is geoarchaeology?

Geoarchaeology (sometimes called archaeological geology), at its most basic, can be described as the application of geological techniques to answer archaeological questions. This is an insufficient definition, however, as it makes geoarchaeology sound like the dependent child of its two parents: merely a set of tools, with no independent existence, no theory of its own, no questions of its own to answer. In fact, geoarchaeology today is developing into a coherent discipline with dedicated practitioners: it is no longer ‘geologists who help out archaeologists’, nor ‘archaeologists with an interest in geology’. It is not something that lies between two disciplines, and therefore is neither: it is a discipline of its own that bridges its two parents and draws on aspects of both. Geoarchaeologists devote themselves to deciphering both the natural world and the ways in which humans in the past interacted with it. The papers in this book show the current state of the discipline. Some of the papers (those by *Gillmore et al.*, *Heinzel & Kolb*, *Liu et al.*, *Raab et al.*, *Sampietro & Neder* and *Trapeznikova*) were presented at one of several geoarchaeological sessions at the 33rd International Geological Congress in Oslo, Norway, in August 2008, whereas the others have been contributed since that meeting. Geoarchaeological sessions can also be found at archaeological conferences, and at solely geoarchaeological conferences such as those of the Developing International Geoarchaeology (DIG) series (*Wilson et al.* 2007, and see also the proceedings of DIG 2007, published as volume 78 of *Catena*).

The roots of geoarchaeology can be traced back to the beginnings of archaeology itself. As Butzer (1982, p. 4) noted, ‘environmental archaeology is one of the oldest interdisciplinary bridges in the field. Archaeologists have always been conscious of environmental context.’ As an identified discipline, however, geoarchaeology is generally considered to have developed starting in the 1960s (*Rapp & Hill* 2006; *Rapp* 2007), as part of the growing perception that the data and perspectives of the sciences had to be more systematically incorporated within archaeology. A classic publication of the time is that of *Clarke* (1968), who pointed out (p. 636) that ‘the relationship between

analysts and their data may be as much enlightened by simple changes in viewpoint as by direct augmentation of the quantity of data. Archaeologists have concentrated far too much upon increasing the quantity of their data and far too little upon increasing the quality of their conceptual apparatus.’

In the early days geoarchaeology probably still was the dependent child, contributing to adding more data and not to changing the conceptual apparatus. By 1982 Butzer (1982, p. 4) was bemoaning the fact that ‘What remains poorly articulated is the equally fundamental environmental dimension ... [There is] ... substantial empirical input from those involved in the applied sciences, who nevertheless have little impact on the dominant intellectual currents within archaeology. Perhaps the environment is taken for granted.’

Substantial empirical input remains essential, of course: understanding the place of cultures within their environments requires accurate environmental reconstruction (*French* 2003; *Brooks* 2006; *Rapp & Hill* 2006; *Rech et al.* 2007; *Heinzel & Kolb*). But we are now also moving towards fulfilling the rest of Butzer’s plea. Most geoarchaeologists probably agree with Butzer (1982, p. 4) that ‘the concept of *environment* should not be considered synonymous with a body of static, descriptive background data. The environment can indeed be considered as a dynamic factor in the analysis of archaeological context.’ It is that concept of the environment as a dynamic and ever-changing participant in human lives and cultures, and vice versa, that geoarchaeology can bring to the forefront. In our work we help to eliminate the false dichotomy between ‘nature’ and ‘culture’ that *Head* (2008) decried: false, because culture has never existed divorced from nature, and there is not now (and has not been for a very long time) any such thing as pure nature, unaffected by human activity. Humans are not outside nature. We and nature are intimately involved with each other, so, as *Head* (2008, p. 376) stated, we need to think about and explain our world ‘relationally, in terms of associations rather than separations’. In addition, the geoarchaeological perspective involves an environment that is seen not only as that existing in a single location at a single time, but as one that extends both spatially and temporally outwards in all directions from the location and age of the remains we study. This was well expressed by *Rapp* (2007, p. 4), who stated that ‘human social frameworks and their natural environments have co-evolved through time. A thorough understanding of culture and culture change is not possible without an appreciation of the environmental context. Humans wandered and worked across, and made an impact on, a continuous landscape. It is with the continuous

space–time landscape that geoarchaeologists must and archaeologists should deal.’

Geoarchaeology thus emerges from the interplay between the human-centred discipline of archaeology, with its concern for culture and cultural evolution, and the more empirical, nature-focused science of geology. It has as its central tenet the belief that human life is not separate from the natural world, and cannot be separated from it. This is not geographical determinism: we do not claim that humans behave the way they do because the environment makes them do it. But it does mean that the factors influencing human behaviour include natural, environmental, ones. In common with our parent discipline of geology, geoarchaeologists tend to believe that these natural factors can be measured and understood, although they may be fluctuating and complex. We also believe that for much of the time of human existence, the natural environment has, in turn, been influenced by continuously varying human cultural influences. We take heed of Butzer’s (1982) warning, and aim to chart and understand those interactions, through time and in each area and case, without treating either (human culture or the environment) as a static constant. If we can ultimately extend that understanding into widely applicable generalities, or even ‘laws’, so much the better, although we are not yet close to achieving that goal.

The recent literature, conference presentations, and the contents of this book exemplify the current state of the discipline. Nowadays some geoarchaeological studies include very detailed, small-scale technical analyses of samples from archaeological sites, such as sediments (e.g. Rapp & Hill 2006; Hill 2007a; **Gillmore & Melton**) and micromorphology thin sections (e.g. French 2003; Guttman *et al.* 2006, 2008; Simpson *et al.* 2006; Huisman *et al.* 2009; Sageidet 2009). Others range in scale up to examinations of entire regions over long time periods (e.g. Goman *et al.* 2005; van der Leeuw *et al.* 2005; Brooks 2006; **Rapp & Jing**). They may be concerned with archaeological sites that are tens to hundreds of thousands of years old (e.g. Hill 2007a, b; Rech *et al.* 2007; **Wilson**), from only hundreds of years old up to the present (e.g. Guttman *et al.* 2006; Sandor *et al.* 2007), or any age range between them. Geoarchaeologists are also aware of the importance of information from sources beyond archaeological sites: regional geomorphology, non-cultural stratigraphic sequences, and so on (e.g. French 2003; Rapp & Hill 2006; Wilson 2007a, b; Carson 2008; **Kraft et al.**; **Liu et al.**).

To determine the context of past human lives we study climatic conditions, and also such aspects as soils, geomorphology, hydrology, and the nature

and distribution of natural resources. A quick glance through some recent papers reveals work being done, for instance, on how changing lake levels relate to the distribution of archaeological sites in Maine, USA (Pelletier *et al.* 2007) and around the Aral Sea (Boroffka *et al.* 2006). Past changes to sea level have been shown to have had an impact on the disappearance of the Lapita culture in New Caledonia (Carson 2008), on the distribution of Italian Neolithic sites (Lorusso 2007) and prehistoric American sites (Leach & Belknap 2007), on Chinese civilizations (Zhang *et al.* 2005), and on the use of alluvial gold deposits in prehistoric Ireland (Moore 2006). Problems of increasing aridity have received attention in many parts of the world, including North America (French 2007; Huckleberry & Duff 2008), South America (Neme & Gil 2009; **Sampietro & Neder**), and Europe and the Middle East (Brooks 2006; French 2007; Gillmore *et al.* 2007; **Gillmore et al.**). River courses are also notoriously changeable, and have had their effect on cultures through time and around the world (e.g. Howard *et al.* 2003; Morozova 2005; Adelsberger & Kidder 2007; **Hill et al.**; **Rapp & Jing**).

Work on natural resources ranges from strict analysis of, for instance, the petrography and geochemistry of lithic material, metals or ceramics (e.g. Luedtke 1992; Rapp *et al.* 2000; Moody *et al.* 2003) to determine the natural resources used for their manufacture, into aspects that have some bearing on geological questions of petrogenesis, and also into more archaeological aspects concerning territories and economic strategies (Black & Wilson 1999; Wilson 2007a, b). In this domain, too, geoarchaeology’s contribution to elucidating past human behaviour is essential. In addition, geoarchaeology can contribute to deciphering how past resource use has had an impact on the natural environment itself.

Archaeologists are good at determining past behaviour, usually (but not always) at specific locations (sites). Geoarchaeology is and has been good at reconstructing environments and determining what resources were available and used, so that those sites can be put in their environmental context. We are aware that it is important to consider not only what we find, but where we find it, if we want to understand the interactions between people and nature. The study by **Robertson** provides a good example of the importance of this. We try to understand what aspects of the environment and which resources were desirable, and how they were being exploited. For instance, studies can aim at determining which landforms in a region were considered suitable for settlements (e.g. Oetelaar 2004; Evans *et al.* 2007; **Trapeznikova**) or can explain, through the reconstruction

of past geomorphology or hydrology, why we find sites where we do (e.g. Rømer *et al.* 2006; Rech *et al.* 2007). Based on such data, we can extend our research into other areas and try to find more sites, which will give us more information about what people were doing and how they and their environment were mutually influencing each other at various times.

Although many studies still restrict themselves to presenting the geological data, without making suggestions as to the human side of things, geoarchaeology has gradually been moving beyond its simple descriptive phase. As many of the papers presented here show, we are starting to develop a body of 'middle range' theory: theory that links the reconstructed environment and resources to the cultural remains that we find, and allows us to interpret past behaviour. For instance, my own work stems from studying the provenance of raw materials used for stone tools. It is based on geological theory, in the belief that rocks that formed in different places and/or at different times will have some identifiable physical or chemical difference from each other. Finding those differences allows us to trace archaeological materials back to their source outcrops. This feeds into archaeological interpretation, in the context of theory about human mobility patterns, resource procurement strategies, and so on. It is, however, peculiarly geoarchaeological in that it considers those raw material sources not just as spots on a map, but as locations that need to be understood in the context of all the other spots on the map: as part of a complete landscape. The sources are located at a certain distance from other spots that people used (such as the site where the tools were found), and the intervening spaces, as well as the sources themselves, have topographic characteristics (terrain that is difficult or easy to cross, for instance) and the potential to provide other resources, or hazards to be avoided. Developing geoarchaeological theory thus allows us to interpret past behaviour in a broader way, better grounded in the environment in which people lived.

Much of that theory is still implicit in our work, and not explicitly formulated and stated. It is hoped that publications such as this book, and conferences such as the DIG series, will stimulate a more deliberate and conscious effort to cultivate such theory, allowing us to move more securely into that middle ground of nature–behaviour interactions.

Human interactions with the geosphere

Because it derives from a discipline devoted to deciphering the interactions of cultures and nature over the entire span of human existence, the geoarchaeological perspective clearly can be of great help in

providing context and even guidance in society's present situation of rapid climate and environmental change. There are lessons to be learned. The record of the past shows that sometimes we caused problems, sometimes we suffered from changes beyond our control, and sometimes we found ways of living successfully for many generations in ways that did no harm and (from the human point of view) may even have improved the situation. It might help us now to have some idea of what we did right and what we did wrong in the past, although we are in most cases very unlikely to adopt the actual techniques used. However, we can also learn a salutary lesson from the ways in which past cultures reacted to the mere fact of change: those that resisted, suffered. Those that found new ways of coping generally did better. None came through unchanged.

One of the first major ways that humans started affecting the natural environment was through the use of fire. There is some debate about when the earliest deliberate use of fire was, but it is clear that hominids controlled fire at least several hundred thousand years ago (Goudie 2006). Fire provided humans with tremendous advantages: cooking fires provided heat and light as well as more digestible food; vegetation could be burned to open up the landscape, making hunting easier, and to direct herds of animals to slaughter. Fire could be used for protection from predators, for eliminating vermin and noxious insects, for improving the quality of some lithic raw materials... the list goes on. In turn, however, regular use of fire resulted in major changes to the environment: the more open landscape now contained a different suite of vegetation, including in many cases pyrophytic species that tolerate fire, or even require it to permit germination. The extent of forest was changed, as was the distribution of animal species. It is fair to say that one of the fundamental factors creating the state of the world today, and even in prehistory, has been the use of fire by humans (see, e.g. Raab *et al.*). This has been demonstrated, for instance, by considerable work on Aboriginal fire use in Australia, and by pre-contact cultures in New Zealand, North America, and other parts of the world. Goudie (2006) and Williams (2006) have provided interesting summaries of such work.

The subject of fire leads us straight to the next major way that humans have influenced the environment: agriculture. The use of fire not only changes the vegetation in an area, but enriches the soil temporarily, which is of course the basic reason for the widespread adoption of slash-and-burn agriculture (e.g. Trapeznikova). Many other agricultural techniques have also been developed, and a great deal of geoarchaeological work concerns agricultural landscapes. These studies can reveal additions to soils

(e.g. Bintliff *et al.* 2006; Guttmann *et al.* 2006, 2008; Simpson *et al.* 2006), or other techniques such as terracing (Krahtopoulou & Frederick 2008) or runoff irrigation (Sandor *et al.* 2007), which create or improve arable land, or otherwise allowed communities to manage risk (Zaro & Alvarez 2005). Human land-use practices can have unintended consequences, however, which can be either positive or negative. The negative consequences are unfortunately relatively common (e.g. Wiseman 2007), and often take the form of predisposing a landscape to subsequent erosion, such as in the situations described by Bintliff *et al.* (2006) and Ayala & French (2005). This latter study described a case in Sicily where land-use practices (pastoralism *v.* agriculture) caused some areas to pass a stability threshold, resulting not only in erosion but also in a landscape that was resistant to regeneration after abandonment. The problems that we cause can thus have long-term consequences. On the other hand, work by McCoy & Hartshorn (2007) in Hawaii demonstrated that deterioration of some areas as a result of land use serendipitously resulted in wind erosion-derived enrichment of soils in nearby areas, allowing later reuse of the land.

The interactions of a dynamic landscape and human cultures through time are never simple and straightforward: they are complex, ever-changing, with people ‘winning’ in some respects while ‘losing’ in others, both at any one time and overall (e.g. Kraft *et al.*). Morozova’s (2005) work on the Tigris and Euphrates rivers provides a good example. Periodic avulsions of the river channels would have had negative effects on settlements along those channels, but Mesopotamian farmers were also able to use the floodplain and channel morphology to their own advantage, for gravity irrigation and for access to better drained soils that were less susceptible to flooding and salinization. For this and other reasons, the periodic changes in channel morphology in fact created a beneficial situation for people, as well as a risky one. Furthermore, people were capable of influencing the avulsions, and engaged in activities that could ‘significantly alter, delay, or accelerate natural avulsion processes’ (Morozova 2005, p. 417). These activities included enlarging levee breaks, diverting channels for irrigation, diverting or blocking channels to control water flow to downstream city-states, building walls and levees, and so on. Morozova (2005, p. 418) concluded that ‘Because of the enormous scale of human activity in the Tigris–Euphrates plains over the last 7000 years, it is impossible to ascribe avulsions to natural causes alone . . . [H]igh-risk, low-yield irrigation agriculture, unpredictable river flow, frequent population migrations due to changes in river courses, and constant wars

and tensions between city-states over water supply contributed to instability, population flux, and pessimism of early lower Mesopotamian civilization, as well as to some of its greatest achievements.’

From this perspective, then, we humans are not only subject to natural environmental changes, but are also agents of change in our own right, and our actions often have unintended consequences. What may seem for a time or in one area to be beneficial may be revealed as a problem in the longer term or the larger scale, whereas what seems to be a problem in one area may well have beneficial consequences somewhere else. It all depends on your point of view. The work of Goman *et al.* (2005) provides an excellent example of this. They documented changes along the Río Verde and the Oaxaca coast in Mexico over several centuries during the Formative period (before *c.* 2000 BP). The initiation of agriculture in the highland areas resulted in erosion, which resulted in increased runoff and sediment load in the river. This in turn affected channel morphology, changing the river from a meandering to a braided system, with flashier flow and more floods. This may sound like a negative scenario, but it had at least two arguably positive effects. First of all, the finer sediments were deposited on an expanding floodplain in the lower reaches of the river, thus greatly increasing the area suitable for agriculture. Second, the excess sediments that arrived at the coast were carried by longshore currents and caused the build-up of bay barriers. Behind those barriers, what had previously been a high-energy, wave-dominated coast became a protected estuarine environment, and estuaries are among the most productive marine habitats known. ‘Archaeological and ethnohistoric data show that pre-Hispanic populations exploited the estuaries for key resources such as fish, shellfish, waterfowl, salt, and ornamental shell . . . Given the high-energy wave environment along the Oaxacan Coast, it is possible that exploitation of marine resources would have been difficult until the estuaries formed’ (Goman *et al.* 2005, p. 256). These environmental changes were followed by a population expansion in the lower Río Verde valley and along the coast (Goman *et al.* 2005, p. 257). Human agency can thus have both deleterious and beneficial effects, over time and across space. Geoarchaeological studies can help show us the larger picture, rather than restricting our view to one small slice of time, one small area, or for that matter one particular group of people.

Climate and environmental change can certainly result in societal upheaval, however. Rapp & Jing show that river floods and avulsions resulted in the displacement of entire cities during the Shang period in China. Brooks (2006) discussed the fact that although it has traditionally been thought that

social complexity and urbanization developed during benign times, there is considerable evidence to suggest that such development was often associated with environmental deterioration, especially times of increased aridity. Brooks made two major points about this. First of all, urbanization is associated with increased social inequality and violence, so it perhaps should be seen as a 'suboptimal' adaptation (p. 46). Second, developing urbanization was not the only way of reacting to increasing aridity: increasing mobility, for instance through pastoralism, also worked. Pastoralism in fact seems to have been more resilient and flexible than the fragile early urban civilizations, as it is still practised today. As Brooks (2006, p. 45) noted, 'The resilience of responses based on mobility holds important lessons for the emerging fields of adaptation research and policy, which are developing in response to concerns about current and future anthropogenic climate change . . . Any measures to enhance resilience and promote adaptation must take account of local contexts and recognize that imported developmental models may be inappropriate; indigenous livelihood strategies have often emerged from centuries or even millennia of linked environmental and social change.'

Sandor *et al.* (2007) also discussed the implications of their geoarchaeological study for our current situation. They looked at runoff agriculture, which has for millennia allowed crops to be grown successfully in arid lands, as it not only increases water supply to the crops but also results in enriched soils owing to the influx of nutrient-rich organic matter and sediments. The fields that they studied in the Zuni area of the USA have been farmed for at least 1000 years, 'making them among the oldest identified fields in the United States. The age and continuity of these sites make it possible to greatly extend the time perspective on the impacts of agriculture on soil resources' (p. 360). This is the time perspective, they point out, that is 'envisioned in the concept of agricultural sustainability' (p. 361). The traditional Zuni method can be seen as much more beneficial to the land and the society using it than the more 'modern' methods that have been imposed by the government over the last century. On the other hand, as Morrison (2007) explained using examples from India, modern degradation of the environment is not always in contrast to past stability. Earlier populations were also capable of making major, detrimental, changes to soils, vegetation, and watercourses.

The need for a long time-perspective was repeated by van der Leeuw *et al.* (2005), who decried the fact that 'most of the research on environmental degradation is concerned with very short time-spans, of up to a century at most. As a

result, the approach is inadequate in a number of different ways' (p. 11). Because degradation is often long term, involving multiple processes with multiple time scales, and intersecting with each other both spatially and in terms of dynamics, 'We need to place the study of degradation in the context of other phases of landscape formation, such as soil formation, expansion of the vegetation, and human behavior that does not result in degradation. Doing that on the basis of data concerning the present alone is impossible' (p. 11).

Dealing with current and future change

The thesis of this present book is that geoarchaeology, by providing us with a longer time perspective on human–nature interactions, can give us a better understanding of how the changes that we currently face will affect us. It can also show us that some adaptations have been less deleterious, even more beneficial, than others over that longer time span. Can it help us plan for the future? There will never be a simple answer to that. The papers in this book show that the possibilities offered by nature, such as the distribution of amenable soils or landforms in climatically suitable areas (e.g. **Trapeznikova**), constrain the possible societal responses. They also show that human activities (e.g. **Liu et al.**) can have an impact on seemingly unrelated aspects of the environment. We are involved in a complex and highly dynamic system. It will not be easy, and may not even be possible, to predict what changes are coming nor how best to respond to them. As Brooks (2006 p. 46) stated, 'The archaeological record emphasizes that adaptation has in the past been associated with great social upheavals that could not have been foreseen by those who were undertaking the adaptation. The consequences of adaptation were unplanned and unpredictable, arising from the ad hoc responses of a variety of actors to environmental change.' Brooks went on to state that we would be naive to think that we can neutralize the effects of abrupt climate change through planned adaptation strategies.

A similar viewpoint was expressed by van der Leeuw *et al.* (2005, pp. 25–26), who pointed out that 'many so-called "environmental crises" are in actual fact just as much societal as environmental . . . such problems are in effect instances of the inadequacy of the mechanisms by which societies deal with the dynamics of their surroundings . . . As a society interacts with its environment according to its world-view, it will rely upon, and impact on, certain aspects of that environment. The society's impact on its environment is, therefore, in those domains where the society is the most

dependent upon that environment. That is where the society is the most vulnerable, and where it finds adapting to changes occurring in its environment most difficult.' For these researchers, any attempt to maintain stability is ultimately doomed to failure. Over the last couple of centuries, our society has achieved a semblance of stability by becoming highly dependent on technology, but 'the problems facing us cannot be dealt [with] in the time-frame available to us' (p. 26).

This pessimistic view may well be correct, but it seems to me that it is better to try to solve our problems, even if the job sometimes seems hopeless. (In fact, van der Leeuw & Redman (2002) apparently agreed, as they called on archaeologists to actively engage in addressing problems relevant to contemporary society.) In our current situation we are facing potentially great changes, and societal upheaval is arguably already under way. However, this is in fact nothing new: societies have always had to change. The more we know of past environmental and societal changes, the more context we have, and the better our chances for dealing with present and future changes. Geoarchaeology can play a leading role in the present and the future by showing us a more accurate picture of the past, by emphasizing the inescapable interweaving of society and nature, and by refuting the dual myths of constant stability and constant progress.

Twenty years ago Bruce Trigger (1989, pp. 410–411) described the contribution that archaeology can make to social change. His words are still pertinent today, and, I would say, even more so if you substitute 'geoarchaeology' for 'archaeology', and 'environmental' for 'social': 'The fact that archaeology can provide a growing number of insights into what has happened in the past suggests that it may constitute an increasingly effective basis for understanding social change. That in turn indicates that in due course it may also serve as a guide for future development, not in the sense of providing technocratic knowledge to social planners but by helping people to make more informed choices with respect to public policy. In a world that has become too dangerous for humanity to rely on trial and error, archaeologically derived knowledge may even be important for human survival. If archaeology is to serve that purpose, archaeologists must strive against heavy odds to see the past as it was, not as they wish it to have been.'

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