

# Nothing Lasts Forever: Environmental Discourses on the Collapse of Past Societies

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Published online: 11 January 2012  
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**Abstract** The study of the collapse of past societies raises many questions for the theory and practice of archaeology. Interest in collapse extends as well into the natural sciences and environmental and sustainability policy. Despite a range of approaches to collapse, the predominant paradigm is environmental collapse, which I argue obscures recognition of the dynamic role of social processes that lie at the heart of human communities. These environmental discourses, together with confusion over terminology and the concepts of collapse, have created widespread aporia about collapse and resulted in the creation of mixed messages about complex historical and social processes.

**Keywords** Collapse · Determinism · Environment · Narrative · Resilience

## Introduction

Scholarly and popular interest in the collapse of societies has produced a vast and multifaceted discourse (Aimers 2007; Anderson and Chase-Dunn 2005; Denning 1999; Lawler 2010; Moyer 2010; Vince 2009; Webster 2006). Collapse is addressed at a number of scales, including the destruction or abandonment of individual sites, the end of archaeological and historical cultures, systems, and empires, and in grand narratives of human history and theories of social change. It is of particular interest to those studying the past because it embodies a range of key issues in the theory and practice of archaeology and history. It offers a way to study and characterize the causes and manner of historical change (structure versus agency), while also being a representation of it. Collapse raises issues of how the past is divided up for study (naming and periodizing), of what constitutes appropriate explanation, description,

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and narrative, of how and by whom the past is used, and who it represents or fails to represent. Like all social sciences, archaeology is embedded within and reflects contemporary cultural, intellectual, political, and social concerns; collapse studies is no different (Fash 1994; Possehl 1997; Preucel and Mrozowski 2010; Silberman 1998).

The study of collapse is a cross-, multi-, and interdisciplinary pursuit not only in archaeology and the social sciences but also in the natural sciences (Costanza et al. 2007a, b). There are multiple discourses of collapse within and between discrete fields, as well as attempts from different perspectives at more synthetic accounts. All of these generate a great deal of evidence, theory, and narrative, which challenge archaeologists to understand and integrate scientific data on ancient climates and environments into their reconstructions of societal change; it equally requires harder scientists to pay attention to how the past is constructed and reconstructed in the social sciences (Lowe et al. 2009). One clear effect of the increasingly available paleoenvironmental data, alongside contemporary concerns over climate change, human impacts on the environment, and sustainability, has been a return by archaeologists and others to more-or-less deterministic views of change in human societies (Crumley 2007).

These views take three broad forms. The first places climatic change as the primary driver of historical change; the second promotes the view that complex societies tend to degrade and outstrip their landscapes, in effect committing “ecocide.” Both positions share a catastrophic approach to collapse, in which the human societies in question are the victims of disastrous demographic and social collapse. The third strand, often incorporated into the first two but sometimes distinct, adopts an approach from catastrophism that natural and geological hazards may result in social change of various kinds.

Although these discourses by no means represent the full range of scholarly opinion on collapse, they are currently highly visible in the literature on numerous ancient societies. They are represented not only in popular books but in archaeological journals (region-specific as well as environmental archaeology), social sciences and sustainability literature, and the journals of harder sciences concerned with Holocene and Quaternary studies, geology, and climate change. They also represent the accepted public face of collapse (Abate 1994; Lewis 2010; Tainter 2008). I suggest that they are paradigmatic in that they are shaping and creating a very particular discourse of collapse as primarily an environmental phenomenon [Trigger 1989, pp. 5–6; Manning (2007, pp. 101–102) also is informative here].

This situation presents problems and opportunities, for it highlights a lack of communication and engagement between specialists and specialisms, as well as a failure to communicate clear messages from academia to the public. As Pyle has noted (1997, p. 60), “while the scientific community has a duty to disseminate results to the wider world, popularists of science have an even greater responsibility to ensure that their message is not only clear, but based on fact or justifiable inference.”

One effect of such mixed messages is the reduction of public faith in academic research; even more worrying is the use of what are, in reality, contested narratives of past societal collapse to shape policy (E. U. n.d.; Fraser 2009; Glenn and Gordon 1998; Glenn et al. 2009; The Millennium Project 1997; cf. Fagan 2006). The failure to question a paradigm that situates collapse as primarily an environmental or

ecological issue and does not consider the role of human culture, contingency, and agency results in a very partial and misleading narrative of human history.

Rather than focusing on collapse, many archaeologists now stress the adaptability and resilience of human communities in the face of environmental change and natural hazards (McAnany and Yoffee 2010a; Santley et al. 2000; Scarborough 2007, 2009). Despite differences of scale and technology between many modern and past societies, archaeologists are recognized as being able to generate data and perspectives on how past societies managed issues of water, land, and other resources, as well as how they coped with and responded to environmental hazards such as drought and climate change (Bawden and Reycraft 2000; Hassan 2002; Leroy et al. 2010; Mitchell 2008). Behaviors traditionally associated with collapse, such as migration, changing strategies of subsistence or resource use, and abandonment of monumentalism or complex administrative regimes, are now viewed by some as adaptive strategies, either socially or environmentally.

The question of whether collapse is a “bad thing” or a “good thing” is still worth asking precisely because answers rely ultimately on imagining the perspectives of the subject (individuals, groups, classes, and narrativized and characterized societies, or periods of time) (Pluciennik 1999). But if resilience and adaptation in some cases result in collapse, and other times mean that collapse did not take place, the matter can easily become confused. In fact, the collapse discourse is typified by confusions arising from the different uses and meanings associated with its terminology and concepts.

The task of identifying, describing, and explaining collapse requires consideration of and sensitivity to the material evidence itself and the processes affecting its production, use, survival, and acquisition. New categories of evidence sometimes appear, as a result of both changing perceptions of what constitutes evidence and the development or refinement of techniques; at the same time existing evidence can be added to and reinterpreted. The material evidence and its interpretations are not static bodies of knowledge. The evidence is interpreted with reference to a number of themes, including human agency and motivation, economic, environmental, social, and political processes, and contingent events. It can be considered at local and wider scales (or systems) and at shorter or longer time scales. Because many of these are dynamic, both as they were and as we theorize them, getting a grip on collapse can be far from straightforward.

My aim in this paper is to provide a selective and critical review of the current environmental discourses in collapse and a point of entry to collapse studies in general. I first examine the language and concepts of collapse and then discuss three environmental approaches to explaining collapse—climate change, ecocide, and catastrophist. These approaches are examined through seven case studies. I offer alternative perspectives and provide final comments on the significance and future of collapse studies.

## **The language and concepts of collapse**

The terminology of collapse is widely recognized as unclear and problematic; even the existence and utility of collapse as a concept is sometimes called into question

(Ardren 2005; Lawler 2010; Lincoln 1989; Rose 1999). Collapse is a loose term that collocates with a range of equally problematic words and concepts such as decline, fall, crisis and anxiety, transition, and transformation. It is often regarded as catastrophic in terms of either population loss or cultural change. As Demarest notes (2001, p. 105), it is often the ambiguity over what is meant by the term, as well as what kind of entity it is applied to, that creates many of the problems and disagreements in collapse studies.

### Collapse, fall, and units of study

A number of scholars define what they mean by collapse and suggest to what kind of human organizations it may apply. Tainter considers collapse a political process in which there is “a rapid significant loss of an established level of sociopolitical complexity” (Tainter 1988, pp. 4–5). In his view, a sociopolitical entity of any degree of complexity can experience collapse, which is a process of simplification and reduction of parts that occurs over a few decades due to declining returns on complexity (Tainter 1988, p. 38). It is applied to anything from empires, states, chiefdoms, local or regional systems, and even individual sites (Alcock et al. 2001; Anderson 1994, 1996; Friedman 2007; Sinopoli 1994, pp. 168–169; Weiss and Bradley 2001). Schwartz’s definition of collapse reflects this application and includes “the fragmentation of states into smaller political entities; the partial abandonment or complete desertion of urban centres, along with the loss or depletion of their centralizing functions; the breakdown of regional economies; and the failure of civilizational ideologies” (Schwartz 2006, p. 5). Renfrew includes the disappearance of elites in his definition, since it is often aspects of the material culture associated with elites that disappears in collapse (Lawler 2010, p. 907).

Cowgill (1988, p. 256) proposed that collapse and fall should not be used to describe the political fragmentation of large states or empires into a number of autonomous political units. The reasoning is that the fragmentation of an empire may not involve loss of complexity in the parts that outlast it; the empire itself no longer exists politically, but the societies involved do not collapse socially. Yet this is precisely how Motyl (2001, p. 4) and many others define or use the term collapse in practice.

Another issue is whether “dynastic” change should be considered collapse (Bronson 1988, p. 197; Lincoln 1989, p. 466). Is dynastic change simply a kind of regime change within a continuing entity (as with the Soviet Union), or does it involve the destruction of a political unit and its replacement (which might nevertheless be made to replicate its predecessor in numerous ways)? Both types of change are found in Chinese, Mesopotamian, and Pharaonic history (Abel 2007; Campbell 2009; Lewis 2007, pp. 51–74; Li 2006; E. Morris 2006; Yoffee 2004, pp. 53–59). Recognition of different kinds of dynastic change allows clearer observation of the “pulsing” between periods of increased unity and fragmentation of competitive independent units that has been identified in a number of ancient systems (Marcus 1998).

Collapse occurs to entities *within* civilizations, defined as the “cultural tradition in which the state is embedded” (Yoffee 1988b, p. 45). It is necessary to “clearly

differentiate between *state*, *society* and *civilization* and use the last term in a specifically *cultural* sense” (Cowgill 1988, p. 256). With the transformation of civilizations visible in changing material culture and practices, there is sometimes a clear, if complex, connection with conquest, colonialism, and contact (Day 2008; Deagan 1996; Gosden 2004; Silliman 2005). Pharaonic Egypt and Mesopotamia were incorporated into a number of supraregional empires in which the value and utility of traditional behaviors that signified their “civilization,” especially higher-status practices, were unlikely not to change (Bowman 1996; Geller 1997; Houston et al. 2003; Rempel and Yoffee 1999; see also Wood 1998; Yoffee 2010).

The transformation of Harappan civilization, too, has been associated with invasion of some kind that led to similar changes, from Indic to Indo-Gangetic traditions, though the old idea of an “Aryan invasion” is discredited (Kenoyer 2005, 2006; Lawler 2008; Possehl 1997). It is still not clear how the Harappan urban societies were organized, or whether they were states or not (Possehl 1998; Smith 2006, p. 116; Thompson 2005). The deurbanization (an indicator of collapse) of some long-lived centers around 1900 BC was followed by more regionalized traditions, but Kenoyer (2006) characterizes the period to c. 1300 BC as one in which there also was a great degree of cultural continuity, as well as the appearance of new traditions, some of which were linked to Harappan ones.

Collapses occurred within Chinese, Greek, Pharaonic, Maya, Mesopotamian, and other cultural traditions without those civilizations disappearing (Cowgill *in press-a*). Indeed, the past has often been used and manipulated in the generation of new social and political units and identities post-collapse (Bronson 2006). The collapse of palace societies in Late Bronze Age Greece and of Classic Maya states involved the disappearance over time of political units and ideologies. Although particular aspects of material culture and ideology that had been widespread, especially connected to the high elites, did disappear, and there were changes in population levels and settlement distribution, neither Maya nor Mycenaean civilization or people disappeared. The western Roman Empire collapsed as a political unit in the 5th century AD, yet what we could term “Roman civilization” was partly adopted by new elites and continued its ongoing transformation within newly autonomous but still interconnected regions that shared some form of Roman heritage (Sarris 2009; Wickham 2009).

Broader cultural transformations were of course influenced by changing political situations, as collapse often involved shifts in the social and political capital of cultural symbols. Collapse both reflects and drives visible change through the medium of social reproduction in changing contexts. In this sense, what we see as collapse is a reflection of social and political realignments (Eisenstadt 1988). Political entities, civilizations, and material culture are interrelated, but it is political entities that collapse.

#### A demographic disaster?

Confusion over what collapsed, as well as the visible changes in material culture, shifting settlement patterns, and destructions and/or abandonments associated with collapse, has led at times to the incorrect assumption that widespread depopulation,

often followed by some kind of sparsely populated dark age, is a typical feature of collapses. As McAnany and Yoffee noted (2010c) in a recent letter to *Nature*, “the conflation of profound societal change with the notion of biological extinction is a persistent error that runs through much ‘collapse’ scholarship.”

One reason for this is the association of collapse with sudden catastrophic population declines or extinctions in the biological sciences and ecology (Scheffer et al. 2001; Van Englesdorp et al. 2009; Washington-Allen et al. 2009). Another is the widespread depopulation association with colonialist ventures in the Americas, Australia, and the Pacific, which destroyed specific sociopolitical entities on a number of scales and led to the profound transformation of local cultures (Palka 2009; Silliman 2005). Such depopulation is often linked directly with the introduction of new diseases, but other less direct effects of disease and other colonialist processes also were at work (Kirch and Rallu 2007; Lovell 1994; Peiser 2005; Thornton 1997). Ecological and biological usages of collapse, as well as violent and apocalyptic images of historical change and transformation, and colonialist narratives themselves (Van Dommelen 1997), influence such perceptions of collapse.

Overshoot explanations of collapse also focus on depopulation and Malthusian disaster (Culbert 1973, 1988; Redman 2004). In these explanations a growing population becomes unable to support itself in its environment and undergoes sudden catastrophic demographic and social collapse. This is sometimes seen primarily as a result of initially successful environmental adaptations that eventually resulted in overpopulation and carrying capacity being surpassed. Sometimes anthropogenic environmental damage, abrupt climate change, or other proximate causes are cited as stress factors that can cause demographic collapse when a system is under pressure and has become less resilient.

The view that overshoot explains collapse in general, and a number of collapses in particular, has been soundly critiqued (Tainter 2006a; for Ur III see Adams 1988; Michalowski 2008; Pollock 1999; Stone 2002; Thompson 2004; Van de Mierop 2007; Weiss 2000; Yoffee 1988b, 2004, 2010). In many cases the demographic reconstructions on which such narratives are based are widely divergent (Chamberlain 2006; Hassan 1999).

The use of “cultural collapse” to indicate what is really demographic collapse or depopulation (Chamberlain 2006, pp. 184–185) or the collapse of an empire (Khadkikar et al. 2004, p. 52) conflates very different ideas. Diamond’s broad definition seems to incorporate this view of collapse as “a drastic decrease in human population size and/or political/economic/social complexity, over a considerable area, for an extended time” (Diamond 2005, p. 3). But the strict emphasis on population is not applicable to many well-known examples of collapse (McNeill 2010).

Reductions in population connected with collapse do often appear in the archaeological record even if collapse itself is not primarily a demographic phenomenon. Yet the contemporaneity of habitation sites, the time scale of any decline, potential changes to the visibility and patterns of habitation and subsistence, and issues of site formation, preservation, and identification need to be considered (Lewit 2009, p. 79; Stone 2002).

## Decline and fall, or transition and transformation?

The word decline often is applied to populations and numbers of sites, where it simply means a reduction. It also refers to reduced military or economic power (Motyl 2001). When associated with collapse, however, it has a range of vague and subjective meanings associated with anxiety, crisis, decay, decadence, difficulties, failings, loss of ability, and moral or aesthetic judgments about aspects of a culture (Tainter 1988, pp. 74–86; Yoffee 1988a, p. 14). A long-standing discourse in Western culture since before classical times also loads the term (Herman 1997).

Decline should not in itself indicate the end of something, as collapse and fall do. Tainter states that “losses that are less severe, or take longer to occur, are to be considered cases of weakness and decline” (Tainter 1988, p. 4). Diamond suggests that collapse is an “extreme form of several milder forms of decline,” in which “it becomes arbitrary to decide how drastic the decline must be before it qualifies to be labelled as a collapse” (Diamond 2005, p. 3). Turchin claims that “historical empires themselves, as often as not, were in the state of decline or even disintegration” (Turchin 2006, p. 4). Here it may be more appropriate simply to recognize ancient states and empires as less permanent and less strongly integrated units that were not unlikely to come apart.

Already in the work of Ibn Khaldun (2005, p. xii), dynastic collapse was preceded by decline. As Bronson observes, “the symptoms of decline are rarely easy to recognize, in spite of the folklore that tells us that things get worse as the end approaches” (Bronson 1988, p. 198); supposed indicators of decline can be identified in societies that do not go on to collapse. Narratives in which the Western Zhou experienced a loss of power between 934 and 771 BC, when the dynasty ended in military defeat, are a case in point.

Li (2006, p. 194), for example, recently attributed the collapse of the dynasty to a contingent explanation, the effects of a particular military strategy adopted by the last king, and suggested that the dynasty could have survived longer if it had not adopted the strategy in question. But he places this event in the context of decline, “at a fundamental level, the fall was the result of the long process of Zhou’s gradual weakening” (Li 2006, p. 232). Shaughnessy gives a different perspective, concluding that the year 771 BC would have seemed little different from the years either side of it. Rather than an “unremitting series of crises” (Shaughnessy 1999, p. 351), he emphasized that the Western Zhou period was important as the era in which much that underpinned later Chinese history was created or reinforced.

In other instances of collapse—Harappa, Late Bronze Age Greece, the western Roman Empire, and Teotihuacan—there are similar debates about whether collapse was preceded by some form of decline that caused or allowed collapse to take place, or whether no decline was necessary and collapse took place under contingent circumstances (Cowgill 1997, p. 156; Dickinson 2006a, pp. 41–43; Goldsworthy 2009, pp. 139–153, 405; Lahiri 2000; Possehl 1997, p. 463; Wright 2010, pp. 320–324).

The polarization between contingency and process is misleading though, since both clearly affect the trajectories of human history. Assuming that collapse must be preceded by decline, anxiety, or crisis influences interpretations of evidence to fit

that narrative. While decline of various sorts may be real, the implications of the term and the way such decline is identified should be made explicit.

Terms now more commonly used, such as transition, change, or transformation, are more neutral, especially when applied to civilizations (Ward-Perkins 2005, pp. 4–5); they are used with this intention in Demarest et al. (2004a) to discuss Maya archaeology. The world of late antiquity, too, is identified as “world in transition,” not in “decline from some previously lofty standard” (Bowersock 1988, p. 170; see also Ando 2008; Bowersock 1996; Bowes and Gutteridge 2005; Lewit 2003, 2009). However, these can be equally controversial and value laden. Ward-Perkins criticizes an EU-funded project on “The Transformation of the Roman World” (Pohl 1997), since “there is no hint here of ‘decline,’ ‘fall,’ or ‘crisis,’ nor even of any kind of ‘end’ to the Roman world” (Ward 2005, p. 4). Transformation suggests that Rome lived on, but it gradually metamorphosed into a different and not necessarily inferior form. Others also emphasize what they see as reduced standards that people would have experienced, while according the period in question no lesser historical value (Liebeschuetz 2003; Loseby 2000).

### Collapse as a lived event and a constructed narrative

Ward-Perkins reminds us that the words we use both signify the historical experience of individuals and relate historical reconstructions and narratives on a number of scales. The word “transition” may mask the real horrors experienced by people during particular historical events and changes, even as it successfully describes changes in political, social, and material culture. Equally, terms such as “anxiety” or “crisis,” used to characterize periods, may fail to communicate the active and positive engagement of people with events and circumstances they experience. At the level of archaeological or historical narrative, writers must consider who and what their words represent, and to whom (McGuire 1992; McGuire and Walker 1999; Ren 2006; Rubertone 2000; Wilcox 2010; Wilk 1985).

These caveats also apply to the word “catastrophe,” used by Drews (1993) to describe collapses in Late Bronze Age Greece and the eastern Mediterranean around 1200 BC. Drews concluded that this collapse was “for those who experienced it, a calamity,” and that it was “arguably the worst disaster in ancient history” (Drews 1993, p. 3). Warfare, violence, relocation and resultant trauma from dislocation are noted as features of many collapses, including in Late Bronze Age Greece and the eastern Mediterranean (Bryce 2005a, pp. 329–340, 2005b; Dickinson 2006a, pp. 55–56; Matthews 2004), the Petexbatun in the southern Maya lowlands (Demarest 2004, p. 255), Cahokia (Pauketat 2004, pp. 151–159), the Four Corners region of the southwestern US (Plog 2008, pp. 146–151), and Wari and Tiwanaku (Janusek 2008, pp. 291–292, 294–296).

Catastrophe indicates sudden and severe change; in this sense it is related to the geological catastrophism associated with Cuvier, who suggested that extinctions in the fossil record were caused by periodic catastrophic geological events (Hallam 2004, pp. 8–11). Catastrophism is again present in geology and biology, for example, in the punctuated equilibrium hypothesis of species change and ecosystems shifts (Scheffer et al. 2001). The current recognition of the dynamism

and instability of the global environment may also encourage a more general application of catastrophist thinking to both the history of the human species and social history (King and Bailey 2006).

Even though the political fragmentation of an empire could be relatively peaceful (Lincoln 1989, p. 461), the shifting capital and utility of certain identities and practices also could result in less obvious kinds of tension and trauma. The diverse fates of Anglo-Indians, an identity group created as a by-product of imperialism within a specific sociohistorical context, during and after Indian independence and partition, provide interesting examples (Blunt 2003; Caplan 2001; McMenamin 2006). Herodotus (1996, pp. 65–67, 462–463) vividly portrays peoples' feelings about the physical abandonment of Greek poleis and their ancestral lands, even though it was conceivable for these to continue even detached from their physical and geographic origins. When such communities did dissolve, a key foundation of a person's identity disappeared; even if not accompanied by violence, this would surely be potentially "catastrophic."

Characterizations of collapse are often implicitly negative, but some scholars also note that these can be considered times of opportunity and even "good" for some (E. Morris 2006). Joyce et al. (2001) argue that collapse tends to be considered a top-down event and that the role of "commoners" has been little considered and undertheorized. They demonstrate that the agency of commoners played a role in collapse and transition in the Río Verde Valley in Oaxaca. This can be recognized through changes in settlement patterns, selective rejection of aspects of elite material culture and practice, and appropriation of sacred spaces reused in new ways—strategies of engagement, avoidance, and resistance. In Late Bronze Age Greece, too, and even the eastern Mediterranean in general, some suggest that the ending of the palace system created a more egalitarian society that was less repressive or burdensome (Betancourt 2000; Deger-Jalkotzy 1996, 2006, p. 174; Van de Mierop 2010, pp. 247–249).

### Dark ages, resilience, and regeneration

The period after collapse has traditionally been characterized as a dark age, a term that is at once comparative and negative, long contested and often unfashionable, but still conceptually present in some form (Bell 1971; Hall 2007, pp. 64–65; Hawkins 2009; Lemos 2010). A recent adoption of the term extends its meaning to indicate periods of environmental crisis, regeneration, and social transformations, even suggesting we may currently be living in a dark age (Chew 2001, 2002, 2005; Modelski 2007).

A dark age refers objectively to a period with comparatively few written texts, sites, or pottery; qualitatively it also characterizes a time perceived as less stable, more violent, less civilized (or urban) and less "good," with material culture that is judged inferior to that of other periods. They are often considered as empty of people and comfort. The term was originally applied to the perceived intellectual darkness of post-Roman Western Europe (Mommsen 1942), but it overlaps with terms adopted elsewhere, such as intermediate or warring states period, and hiatus,

which indicate an interruption of what are often considered in hindsight to be normal or desirable periods of unity, stability, or progress.

Given that human populations rarely disappear completely, “resilience” is now frequently used to stress continuity over collapse, but again the term has been applied with different meanings and implications. Formal resilience theory is grounded in an ecological perspective of episodes of stability and change in human–environment relations (Holling 1973; Holling and Gunderson 2002; Redman 2005; Washington-Allen 2009). The relationship is seen as an adaptive cycle in which collapse is associated with periods of increased population and environmental degradation, the “release” phase of the cycle, while reorganization is the “ $\alpha$ ” phase (Redman 2005, pp. 73, 75). This characterization of the release phase presents it as the result of a maladaptive phase in which downscaling of some kind is forced, resulting in population decrease or dispersal or the abandonment of systems that require high-energy input.

Archaeologists apply this model of long-term adaptive cycles in a variety of cases, including in the southwestern US (Nelson et al. 2006) and Mesoamerica (Scarborough 2009; see also chapters in Redman et al. 2004), but it is unclear whether a shift in terminology from collapse to release, or from dark ages to reorganization, constitutes a conceptual gain. While any human community relies on the carrying capacity of an environment and its environmental threshold, the association of collapse with an overshoot model that is dependent on increasing population and loss of productive potential obscures societies’ methods of buffering and displacing environmental impacts to other locations or in transforming limitations through culture (McNeill 2010), primary features of complex societies today and in the past (Tainter 2006b). The circumstances that render a once adaptive system suddenly maladaptive still result in the proximate cause of collapse being the coincidence of contingent situations.

A second use of resilience is more abstract, emphasizing that human individuals and groups adapt to situations through change and response. This is often the case, but again this stance promotes a more strictly biological or ecological view of human populations that undervalues the role and value of culture. Characterization of the process whereby a human population group survives some shock but their culture is profoundly transformed as either collapse or resilience depends on whether the cultural or biological processes are the object of focus.

Schwartz and Nichols and contributors (2006) focus on the re-emergence or regeneration of complex societies as a sequel to collapse and examine the relation of such societies to what preceded them in ideological and institutional terms. Bronson (2006; see also Lewis 1975) usefully defines the way in which people use or discard aspects of the real or imagined past through stimulus or template regeneration. Kealhofer et al. (2009) recently adopted a regeneration approach for the re-emergence of complexity at Bogazkoy after the Hittite collapse. This approach places a different value on dark ages as periods of reorganization and activity rather than catastrophe and passivity.

The concept of dark ages does carry an implicit judgment, since they are identified precisely because of the disappearance of certain material features associated with complexity. But Tainter (1999, p. 1025) has observed that since it

tends to be aspects of elite culture that disappear or become more restricted in collapse, dark ages may have been little different for the majority of people. Morris (1997), too, has emphasized how modern divisions of the past into periods have led to the construction of the Greek dark age (c. 1200–700 BC), and this conclusion must be extended to consideration of other “dark ages.”

Is collapse usual or unusual?

McAnany and Yoffee’s edited volume (2010a), which stresses the adaptability and resilience of various human communities, is a response to Diamond (2005) and the ecocide school of catastrophic collapse. Its publication sparked a public debate between the editors and Diamond about what collapse is, why it happens, and the degrees and role of human agency (Diamond 2010; McAnany and Yoffee 2010c). It returns us to the question of what researchers consider collapse to be, how it was and is perceived, and the utility of the term.

McAnany and Yoffee and their contributors (2010a) question the view that there have been many instances of collapse *qua* avoidable catastrophic self-induced environmental disasters. They maintain that “‘collapse’ in the sense of the *end* of a social order and its people” is rare (McAnany and Yoffee 2010b, p. 11). Archaeologists participating in a recent Cambridge conference on collapse came to a similar conclusion (Lawler 2010).

Collapse and demographic collapse should not be conflated, since each can occur mutually exclusively of the other. Yet in seeking to reject the ecocide narrative, McAnany and Yoffee (2010a) at least appear to suggest that collapse almost never happens. Although very specific demographic/social collapse may indeed be rare, collapse as primarily a sociopolitical process involving profound change is not rare but a “process recurrent in history and prehistory” (Liverani 2001, p. 379; Tainter 1988, p. 5).

This mixed message about collapse could be taken to imply that sustainability and environmental change are of no concern because humans as a species tend to be resilient. It is not surprising that some prefer to avoid the term altogether and wonder “why the terms ‘collapse’ and ‘fall’ are still used today to describe complex processes of cultural evolution or transformation” (Ardren 2005, p. 225; Rose 1999). Despite these issues, collapse is far from an empty category for the analysis or categorization of social change, even if it is undertheorized (Janusek 2008, p. 209). Collapse is neither a concept in thrall to a view of past societies as static or monolithic nor one that privileges civilization over barbarism—both no longer admissible propositions. Even though it is often possible to identify collapse only in hindsight, the question of whether it went unnoticed “on the ground” presents a false dichotomy between the possible experiences of an individual at the time and that very hindsight that makes the practice of history possible.

Collapse is a term ascribed to a range of processes and events that at their core have rapid or dramatic political and social change. That change has correlates in material culture, whether at the level of the political fragmentation of large empires or the demise of individual polities within a culture zone. It can result in and be a part of the transformation of a culture or signify the end of materially distinct

communities. The onus is on writers to indicate clearly what they mean by collapse and not to confuse or abandon the concept.

### **Environmental approaches to the causes of collapse**

Janusek optimistically notes (2008, p. 290) that archaeologists interested in collapse now emphasize the role of human agency and the political, social, and ideological drivers of collapse as opposed to traditional explanations, such as mass migration, or external causes, such as the environment. This is only partly true, however, and does not represent the diversity of discourses within collapse studies. The reality and role of migrations, for example, continue to be an important, if controversial, focus of debate for the c. 1200 BC collapses in the eastern Mediterranean (Yasur-Landau 2010), and in Mesoamerica (Cowgill *in press-b*). Debate also continues over the potential role in collapse of abrupt or long-term climate change, anthropogenic environmental damage, and catastrophic events. Inevitably, these debates raise issues of agency, choice, and determinism, and challenge researchers to successfully balance event and process-driven interpretations of the past.

Collapse is approached from a number of theoretical perspectives that can and do cycle, falling into and out of fashion (Erickson 1999; Huntington 1915, 1917; Issar and Zohar 2007; Webster 2002, p. 239). Since archaeology is itself a complex system consisting of diverse interlinked communities, this cycling may be asynchronous. What is currently of interest in one subfield may be currently unfashionable in another. Here I discuss under three broad headings (in practice there is overlap; see Reycraft and Bawden 2000, p. 4) those environmental approaches that appear to be highly prominent in current discourses on collapse.

#### **Climate change and neodeterminism**

The resurgence of explanations of collapse and historical change as driven primarily by, or profoundly affected by, long-term or abrupt climatic changes that affected the conditions of subsistence and production is unsurprising given current concerns over climate change and global warming (Abate 1994; Behringer 2010; Christie 2008; Fagan 2008; Fleming 1998; Linden 2007; Manzanilla 1997). The scientific study of paleoclimatology also has revealed the profound dynamism and instability of local, regional, and global climates in the Holocene and has enabled climatic change to be mapped chronologically with a high degree of precision (Alley 2000; Botkin 1990; Dincuze 2000; Kuniholm 1990; Maher et al. 2011; Mayewski et al. 2004). Past climate can no longer be assumed to have been identical to today nor to have remained static, and past climate data require consideration and integration into reconstructions of the past (Bryson 1994; Fagan 2004). In fact, paleoclimatic studies have already profoundly impacted the study of collapse and culture change, and a new determinism is in evidence.

A number of recent publications by archaeologists, historians, climate scientists, and others see climate as stimulating societal change, both collapse and increasing complexity, in a number of past societies (Benson and Berry 2009; Benson et al.

2007, 2009; Brooks 2006; Burroughs 2005, pp. 188–193, 250–260; Charles et al. 2010; deMenocal 2001; Kennet and Kennet 2006; Madella and Fuller 2006; Orlove 2005; Richer et al. 2001; Tsonis et al. 2010; Zhang et al. 2005, 2006, 2007a, b). For some, climate has again become the main driver in human history, “since all human cultures were, and still are, products of their environment” (Issar and Zohar 2007, p. xxvi). Catto and Catto (2004) emphasize the role of climate, even while raising the question of climate change as a “driving force, supporting player, or background noise.” Leroy too suggests that it is right to “resurrect environmental determinism” (Leroy 2006, p. 7). Some archaeologists find this position more defensible in light of numerous apparent coincidences between climatic events and cultural change (Allen 2010; Schiettecatte 2010; Wright 1993).

If archaeologists and historians have sometimes been blamed for a failure to engage with scientific evidence (Issar and Zohar 2007, p. xxv; Kuniholm 1990), it is equally unfortunate that there is also a lack of engagement with ongoing archaeological and historical research and theory from researchers outside these fields. The views of archaeological or historical specialists are sometimes misrepresented or even ignored by specialists in other fields (e.g., Mayewski et al. 2004, p. 252, make no mention of Webster 2002).

Some accounts also perpetuate ideas that are discredited or controversial in archaeological and historical explanations of change, such as simplistic notions of climate-driven mass migrations that often hark back to origin myths and other hard-to-interpret accounts (Behringer 2010, p. 56; Burroughs 2005, p. 258; Neumann 1993; Neumann and Parpola 1987; but see Drews 2000; Hall 1997). Nonarchaeologists, who are perhaps unfamiliar with the contested nature of archaeology, often misunderstand the dynamic nature of archaeological or historical “facts,” in which the event being explained may change or disappear when new evidence appears, or when existing evidence is reconsidered or reinterpreted in different ways. Nevertheless, there has been and continues to be engagement on both “sides” (Buckley et al. 2010; Büntgen et al. 2011; Roberts et al. 2011).

Maher et al. (2011), in their analysis of the role of abrupt climate change in prehistoric cultural change in the southern Levant, highlight a number of germane issues that apply generally to this approach. They stress the need for high-resolution chronological data and note that some episodes of culture change appear to precede the climate changes with which they had been associated (Maher et al. 2011, pp. 9, 18). Such evidence can be difficult to acquire (Manning 2006–2007). They also note that given the varied topography of local areas, global climatic changes would have had differing effects on regional, local, and microscales (Maher et al. 2011, p. 20). The consequences of such shifts on ecosystems are likely to be more complex and less obvious than generally considered (Scheffer et al. 2001). In addition to these problems, Maher et al. (2011, p. 22) suggest that we also question the cultural models under consideration, as they can lump together artifact types, settlement patterns, and chronological periods.

Coombes and Barber (2005) have suggested that human societies, as complex self-organizing systems themselves, react to instances of “forcing” in nonlinear ways: forcing factors of different kinds could result unpredictably in collapse, or not. In addition to understanding what changes actually took place climatically and

then ecologically, and what the human responses were immediately and over time, the scientific evidence itself also needs to be understood and evaluated. The question of the extent to which small data sets that may be global or regional in origin can be meaningfully applied to the explanation of specific local cases of culture needs to be asked (Kuniholm 1990), and the processes that lead to the formation of such evidence within their particular macro- and microenvironments, as well as its final interpretation, must be considered (Town et al. 2008). While none would deny the relationship of human communities to the climate and environment, the question of balancing evidence and causality in interpretation remains problematic. Many archaeologists would agree with Maher et al. that “current evidence (radiocarbon, paleoclimatic and archaeological) does not support simple cause-and-effect relationships between rapid climate-change events and cultural changes” (Maher et al. 2011, p. 3).

### Ecocide and maladaptation

The place of humanity as an interdependent part of environmental systems, though not new, has been seen as increasingly relevant to studies of the past and to current concerns over sustainable practices (Butzer 1982; Costanza et al. 2007a, b; Dincauze 2000, pp. 5–6; Hornborg and Crumley 2007; Redman 1999). The often complex and reciprocal impacts of human cultures and their sustaining environments also are apparent (Dearing 2006; Evans 2003; Hayashida 2005; Kirch 2005; Redman et al. 2004; Williams 2000). These developments have grown up in concert with environmental and conservation movements from the 1960s onwards, resulting in what Trigger (1989, pp. 319–326) terms cataclysmic archaeology. The realization that anthropogenic environmental damage and degradation posed serious issues for sustainability, along with a Malthusian recognition of limits to necessary but finite resources used in industry and the dangers of population growth, has helped create a collapse paradigm for the present.

In some cases, archaeological research demonstrates that human societies can undermine their own environment, resulting in collapse by overshoot (discussed above). A case has been made for this factor in the collapse of Late Bronze Age Greek polities (Runnels 1995, 2000; Wells et al. 1993; see also Bloedow 1995), Chaco (Kohler 1992; Kohler and Matthews 1988; see also Mills 2002, pp. 97–100; Mills 2004; Wills 2009), the Classic Maya (Oglesby et al. 2010; Pringle 2009; see also McNeil et al. 2010), and Mesopotamian Ur III (Jacobsen and Adams 1958; see also Powell 1985). Deforestation and soil erosion in particular play a significant role in this discourse, along with suggestions of increased salinization from irrigation and agricultural intensification (Chew 2001, 2005; Diamond 2005, p. 487; Ponting 2007).

The best-known example of ecocidal collapse is the argument that Rapa Nui (Easter Island) society “self-destructed” in a Malthusian demographic and cultural disaster. Bahn and Flenley (1992) popularized this narrative and the notion that Rapa Nui was a valid analogy for an Earth under pressure. This case is discussed further below. Now it is Diamond’s recent volume (2005) that represents the well-known face of this paradigm (see also Good and Reuveny 2009; Janssen and

Scheffer 2004), but it follows in the footsteps of others (Flenley and Bahn 2003; Ponting 2007; Redman 1999).

The ecocide argument tends to present human societies as existing in a form of maladaptation to their surroundings (Rappaport 1977). The ecological extension of this is that collapse enables a periodic environmental and cultural resetting to take place, and then new societies can develop (Chew 2002, 2005). This alternative form of determinism (deterministic because of the cyclical nature of the process) places responsibility for collapse on the inhabitants of past societies themselves rather than on climatic or other external factors; in practice many discussions mix these causes.

Although expressions of this narrative are often motivated by a well-intentioned desire to help humanity avoid collapse in the present and future by educating people about human impacts on the environment and promoting sustainable practices (though see Kirch 1997, p. 39; MacMillan 2010), this use of archaeology, and in particular the presentation of the history of past peoples and societies involved, has provoked heated debate (deMenocal et al. 2005; Lewis 2010; Tainter 2010). Diamond has drawn the brunt of academic criticism, due in part to the success and visibility of his books (Diamond 1997, 2005). Despite nuancing his views (2005, pp. 11–15), the widespread acceptance of how his narrative is taken to characterize collapse and past societies illustrates the potential for continued miscommunication about collapse.

### Collapse and neocatastrophism

Both climate change and ecocide approaches to collapse incorporate various aspects of catastrophist thinking in terms of the abruptness of climate change events, the suddenness of an ecological collapse, and the effects of these on populations and societies. But catastrophism in a stricter sense, the notion that natural hazards can cause the abrupt end of human societies, also has returned to the foreground in explanations of collapse and social change (Ambraseys 2005; Bawden and Reyecraft 2000; Leroy et al. 2010; Nur and Burgess 2008). A recent popular volume claims that a massive volcanic eruption in AD 535/536 “blotted out much of the light and heat of the sun for 18 months and resulted, directly or indirectly, in climatic chaos, famine, migration, war and massive political change on virtually every continent” (Keys 2000, p. 1). This hypothesis has been received favorably by at least one scholar (Whitby 2000), though not by others (Saunders 2000). In addition to geological catastrophes, plagues and epidemics also take their place in this literature (Acuna-Soto et al. 2005; Little 2007; Walløe 1999).

The resilience of catastrophe-based explanations is often related to their apparent simplicity and the media coverage given to contemporary catastrophes (Ambraseys 2006, pp. 1011–1012; Leroy 2006, p. 10; Rose 1999). But catastrophes have long formed part of human physical and metaphysical experience, and a catastrophe discourse is found in many human societies past and present (Piccardi and Masse 2007; Svensen 2009, pp. 17–33). There has long been a link between catastrophism and biblical archaeology, for example, since geological events can offer rational explanations for biblical events (Bentor 1989; Nissenbaum 1994; Siverstein 2009).

Earthquakes, storms, and droughts are the three most significant causes of mortality by natural disaster between 1970 and 2009, with some 88,000 killed and almost 46 million people affected by the 2008 earthquake in China alone (CRED 2010). The 2010 earthquake in Haiti has been held responsible for catastrophic social collapse in that country, attendant though on the conditions of the country when disaster struck (Robertson 2010). The earthquake that struck Bam, Iran, in 2003 documents the physical damage that could be caused to a premodern city and also the aftereffects in terms of health and psychological trauma (Akbari et al. 2004; Montazeri et al. 2005).

Several reasons explain a general prejudice against catastrophic explanations for societal collapse. The first is that no major society has clearly collapsed as a result of such events. The association of catastrophes with myth and “acts of God” also creates suspicion about catastrophes as appropriate or acceptable explanations (Masse et al. 2007). Another point is that archaeologists in more developed nations tend to be well buffered against the worst effects of catastrophes (as indeed they are buffered from climate change and resource degradation [McNeill 2010]) and simply do not experience these events in the same way as those who live in poorer or less stable societies. Finally, there is the apparent simplicity of the catastrophist approach: what possible damage, at least to more complex societies, can single events cause when “complex societies routinely withstand catastrophes without collapsing?” (Tainter 1988, pp. 53–54).

As an explanation of collapse, Rose (1999) suggests that rather than identifying potential catastrophes, specific proof of their occurrence at a particular time is needed, as well as a demonstration of “how precisely it would have ended civilization...it isn’t enough to say x, y, and z problems existed in a civilization and then a catastrophe pushed everything over the edge.” Clearly, catastrophes can cause collapse in some instances, depending on the scale considered (Greek poleis as opposed to Greek “civilization”). While past and present societies can and do survive catastrophes, it is equally evident that they could affect the production and economies of the affected areas and those linked to them (Leroy et al. 2010). As with Haiti, the social effect of any catastrophe is dependent on a number of other factors and are therefore contingent and not necessarily predictable. Indeed, Leroy (2006, p. 5) notes that the amplitude of a catastrophe is affected by three factors in particular: onset time and duration of the event (time), the area affected in terms of size and use (area), and the type or society and ecosystem affected (type) (see also Reycraft and Bawden 2000). The Bam earthquake killed many because it struck while people were asleep.

Some have attempted to create the kind of narratives required by Rose (1999), though the production of incontrovertible evidence and proof of causality may rarely be possible in a science based on the interpretation of primarily material evidence (Kohl 2008, p. 498). That there are linkages between catastrophes and their effects on society seems uncontroversial (De Boer and Sanders 2002; Nur and Burgess 2008, pp. 246–277). A devastating earthquake that destroyed classical Sparta in 464 BC had the potential to destroy the political state since it facilitated a revolt by the helots; in this case the event provided an opportunity for human action (Hall 2007, p. 286).

Charisma, ideology, and the perception of community, rather than institutions alone, play a role in binding together some human groups, and catastrophes, as much as other events, affect confidence in leaders or systems. Thus, for leaders who maintained an ideological system based on their successful intervention in providing rain, for example, any reduction in rainfall would reflect on their status and challenge the cohesion of the system (Lucero 2002). Leaders and systems that are considered unsatisfactory today are equally prone to revolution and, in some cases, systemic and ideological changes that may look like collapse to future archaeologists (Sanderson 2005).

Issues of subject, scale, and definition are crucial for considering the role of hazards and catastrophe. Mackil (2004) examined a number of cases of polis collapse that occurred because of physical catastrophe. In Greece, the polis of Helike was destroyed by an earthquake and tsunami in 373 BC, completely, according to the literary (but not archaeological) sources, and it ceased to exist as a political unit (Mackil 2004, pp. 498–499). Its former territory was divided among its neighbors. Specific social and political and physical units were abandoned, and people and land that had constituted the lapsed entity were redistributed through processes involving neighboring centers and wider regional social and political networks. Greece did not exist as a political unit, and the polis was the unit of citizenship and identity for most “Greeks” (Hall 2007, pp. 67–92). Neither the wider culture system nor its civilization collapsed because of these events, but that should not be expected. In a microcosm, this is a prime example of the reconstruction of political and social boundaries and identities following a collapse on a particular scale. It also demonstrates how members of one system can become undetectable archaeologically, even though they are not biologically extinct (compare chapters in Higham 2008). Reactions to catastrophic occurrences in other areas provoked similar reactions: both the end of societies and successful adaptations (Chester et al. 2000; Gonzalez et al. 2000; Plunket and Uruñuela 2000).

## Case studies

I now summarize ongoing debates in seven case studies. These examples show how the environmental approaches are applied and contested. They raise questions and issues that apply equally to other cases of collapse.

### Climate change and megadrought

#### *Northern Mesopotamia and Syria*

Based on their excavations and survey in and around Tell Leilan in northern Mesopotamia, Weiss and colleagues proposed that widespread urban abandonment and the collapse of the Akkadian empire was caused by increased aridification around 2200–1900 BC, which followed a volcanic eruption that was contemporaneous with an extended dry period (Weiss 1997, 2000; Weiss and Courty 1993; Weiss et al. 1993). Further supporting evidence for this climate event has been

identified in sediment cores from the Gulf of Oman (Cullen et al. 2000; Staubwasser and Weiss 2006). Weiss and colleagues (1993) argue that these conditions led to desertification and decreased agricultural productivity, especially in the Habur region. This weakened the Akkadian empire, which was economically dependent on the region, and also caused a number of population movements that destabilized other areas of Mesopotamia. They and others associated climate change with other episodes of collapse that occurred around the same time in the Aegean, Egypt, Harappa, and Palestine (deMenocal 2001; Staubwasser and Weiss 2006; Weiss et al. 1993, p. 1002). Weiss and Bradley (2001) later extended the argument to suggest that climate change was in fact the prime cause of societal collapse in general.

Despite the array of evidence and interpretation built up by Weiss and others, their Mesopotamian narrative has not found universal acceptance for a number of reasons (Weiss 1996). Zettler (2003) acknowledged the importance of Weiss' efforts to bring together multiple types of evidence from a range of disciplines but questions Weiss' textual interpretations, the reliability of the absolute chronology, and the central question of Akkadian economic dependence on the Habur region. In terms of historical reconstruction, some note that Weiss fails to consider that the unity imposed by the Akkadian dynasty was itself an anomaly in the usually fragmented political organization of Mesopotamia (Liverani 2001, pp. 377–380; Zettler 2003, p. 24).

Subsequent research has caused Courty to modify her interpretation of the soil data and to raise the dating of the event she identified (Courty 2001). It also shows that the extent of site abandonment in northern Mesopotamia is much less than Weiss and colleagues had supposed and that there was continued settlement at most major urban sites (Kuzucuoglu and Marro 2007; Wossink 2010). Increased resolution of the ceramic chronology also indicates that the timing of changes to urban life, still “urban collapse” in Ur's words, varied across sites and was not as sudden or universal as sometimes presented (Ur 2010, p. 413). The Akkadian collapse seems best understood as a political collapse in which the attempt to create a unified state from competing independent polities was ultimately outweighed by their desire for independence (Roberts et al. 2011; Van de Mierop 2007, p. 71).

### *Classic Maya*

Gill and others have developed an argument that explains the Classic Maya collapse (Terminal Classic period c. AD 750–1050) as a demographic collapse in which millions of people died because of agricultural failure caused by a series of unusually severe and prolonged droughts (Gill 2000; Gill et al. 2007; Pringle 2009). These megadrought events are inferred from lake sediment cores from Lake Chichancanab and Punta Laguna in northern Yucatan (Hodell et al. 1995, 2005) and titanium deposition in the Carioco Basin off northern Venezuela (Haug et al. 2003); they have been linked with solar and volcanic activity (Hodell et al. 2001).

Various dates are given for the droughts, with Hodell et al. (2005) identifying an early phase (AD 770–870) and a late phase (AD 920–1100), punctuated by relatively wetter periods. Curtis et al. (2001, p. 50) proposed that droughts occurred in AD 585, 862, 986, and 1051, and that those of 585 and 862 “coincide with major

changes in Maya cultural evolution” and with the ninth century collapse. Gill et al. (2007, p. 288) assemble evidence for the dates of proposed drought events connected (between AD 760 and 930) with cultural change and note that the Classic collapse took place in four phases of abandonment (AD 760, 810, 860, and 910). They emphasize that the collapse was unavoidable, catastrophic, and due directly to climatic factors: “There was nothing they could do or could have done.... In the end, the food and water ran out – and they died” (Gill et al. 2007, p. 299).

Many are receptive to the idea that droughts and climate change played a role in Maya culture change and collapse, especially in Quintana Roo (Aimers 2007, p. 348; Hodell et al. 2007; Leyden et al. 1998). But many who suspect that drought was a factor in the collapse in some Classic Maya polities nevertheless reject the megadrought hypothesis for several reasons (McAnany and Negrón 2010; Webster 2002, pp. 239–247). One is the problem of creating a single account to explain changes over a wide spatial and chronological area, and from a relatively small sample of very specific evidence. The sediment cores taken to indicate drought are from northern Yucatan, whereas it is the wetter southern lowlands where collapse is most identifiable early on. And the polities of northern Yucatan, closer to where the sediments were actually laid down, did not collapse at the time; rather they experienced “a time of great activity” (Suhler et al. 2004, p. 450) during the Terminal Classic. Their collapses came later, toward the end of the period (A. Andrews 1990; A. Andrews et al. 2003; E. Andrews 1973; Cobos 2004; Demarest 2004, pp. 268–274). McAnany and Negrón (2010, p. 155) note a number of inconsistencies between the water supplies of different centers and the timing of their collapse that run counter to the drought hypothesis.

Demarest notes (2004, pp. 257–260) that in Petexbatun, in the wetter southern lowlands, the problems that led to political collapse appeared in the late seventh century; rather than being sudden, they took over a century to play out as endemic warfare between competing sites took over the region. This created conditions of violence and instability in which demographic decline took place through outmigration and subsistence problems. He also notes that local paleoecological and paleopathological evidence does not indicate climatic change, drought, or famine in the region at the time (Demarest 2006; Dunning et al. 1997; Houston and Inomata 2009, pp. 295–302; Wright and White 1996).

Chase and Chase (2006) examine the transition in the southern lowlands into the Postclassic, seeing a new focus on symbolic egalitarianism. Masson et al. (2006) discuss the formation of the Postclassic state of Mayapan, successor of Chichén Itzá, and demonstrate that aspects of the past were actively used or rejected by the people there (see also Andrews 1993; Demarest 2004, pp. 277–293; Masson 1997; Milbraith and Peraza Lope 2003). Maya states continued to exist along with the Spanish until the last was conquered in AD 1697 (Jones 1998).

Rather than thinking of a single Classic Maya collapse, the Terminal Classic period can best be conceptualized as a long period that was experienced in a variety of ways by people of different status at different sites and in different regions (Aimers 2007; Demarest et al. 2004b; Iannone 2005). Unsurprisingly, Maya culture as a whole looked different at the end of this time, punctuated as it was by numerous collapses, and the Classic era political system based on divine kingship

(Freidel 2008) did not survive. While many sites and systems did collapse, and some areas apparently became widely depopulated, others did not (e.g., Lamanai; Pendergast 1993, p. 18). Some experienced increased population, continued building, and active trade (Masson and Mock 2004). Despite the profundity of some of the events and processes of the Terminal Classic and after, the Maya were resilient both culturally and as a biological population of Mesoamerica.

### *Tiwanaku*

A similar trend in explanations for the collapse of Tiwanaku has been identified by Erickson (1999), who identified a (re)cycling of environmentally deterministic explanations suggested by Posnansky (1945), Paulson (1976), and most recently by Kolata, Binford, and others (Binford et al. 1997; Kolata 1993; Kolata and Ortloff 1996). In this scenario, Tiwanaku agriculture, which had developed a well-adapted raised field system (Erickson 1992), collapsed due to megadrought; there was a “gradual change in precipitation around AD 950 followed by a precipitous change in moisture content commencing with the post-AD 1000 period” (Kolata 1993, p. 285, 287, 297; see also Chepstow-Lusty et al. 1996). This drought changed the environmental threshold, “defined as climatic extremes that limit[ed] the complexity of cultural development,” since the population supported by the successful agricultural adaptation could not be supported in drier conditions (Binford et al. 1997, p. 235). The collapse involved the abandonment of raised fields, population dispersal, and cultural collapse (Binford et al. 1997, p. 243). The evidence for drought comes from ice cores from the Quelccaya glacier in southern Peru and sediment cores from Lake Titicaca (Binford et al. 1997; Shimada et al. 1991; Thompson et al. 1985). Some researchers even see parallel droughts causing both the Maya and Tiwanaku collapses, comparing data from Lake Chichancanab with cores from the now-filled Andean lake Marcacocha (Chepstow-Lusty et al. 1996).

Drought supposedly affected agricultural capacity in different areas in turn, beginning with coastal communities around AD 850–950, then colonies such as those in the Moquegua Valley, which relied on canal-fed irrigation, and ending in the Tiwanaku heartland (Kolata 1993, pp. 294–295). Deteriorating agricultural output led to the fragmentation of empire and the end of elite statuses; “Tiwanaku’s royal dynasty and court life dissolved” and the cities of Tiwanaku and Lukumurta were largely abandoned in the 11th century AD (Kolata 1993, p. 283). Kolata (1993, p. 296) associates the change to a dispersed settlement pattern in the Tiwanaku and Katari Valleys with the disintegration of the organized raised-field agricultural system that he suggests was tied to the elite. Nevertheless, unlike Gill in his megadrought hypothesis for the Classic Maya collapse, Kolata states that “the people of Tiwanaku themselves did not perish *en masse*” (Kolata 1993, p. 299).

Erickson (1999), Williams (2002), and Calaway (2005) critique the climate change hypothesis for Tiwanaku collapse. Calaway (2005) questions the presentation of inferences from the Quelccaya ice core data as “empirical reality,” suggesting that data have been selected to support the drought hypothesis; he offers a different interpretation. In particular, he notes that due to wide fluctuations in precipitation and temperature over both long and short periods, “environmental data

cannot assume a common mean” and thus smoothing data and finding a mean in order to recognize divergences from it may not be appropriate (Calaway 2005, p. 783). Ice cores themselves may not provide the best proxy for environmental changes over time as has been thought, due to highly localized wind patterns, especially in mountain areas; snow deposition and ablation can vary greatly from actual precipitation, and interpretation of this evidence is complex and uncertain (Calaway 2005, p. 786, citing Francou et al. 2003; Vuille et al. 2003). Isotope analysis is also less clear-cut in interpretation than often suggested (Town et al. 2008). Calaway identifies the problem of resolving chronological issues between paleoclimatologists and archaeologists, the former finding longer time scales more acceptable than the latter. In striving to integrate evidence from both, he sees a danger of creating “a partial empirical reality out of constructed scientific knowledge” (Calaway 2005, pp. 787–788). As a factoid, this becomes the foundation of explanatory models.

Erickson (1999) and Williams (2002) both note chronological problems; both suggest that the identified drought postdated the collapse of Tiwanaku and Wari and its colonies in the Moquegua Valley. Williams sees the early collapse of colonies as resulting from issues of water resource use and control between the two powers, leading eventually to local revolts, with Tiwanaku’s Chen Chen being sacked, destroyed, and abandoned before AD 1050 and Wari’s Cerro Baul abandoned in the 11th century (see also Owen 2005). Around Lake Titicaca, he suggests, the evidence seems to show no water shortages until the end of the 11th century, but loss of the maize-growing region of Moquegua may have “increased social susceptibility in the Tiwanaku heartland to severe resource stress that the later drought brought forth” (Williams 2002, p. 372). The sustainability of the Wari state too may have been affected by events in the Moquegua Valley. Erickson notes (1999, p. 635) the continuation of raised field agriculture at Koani Pampa and Huatta, around Titicaca.

While Williams (2002, p. 372) sees the collapse as real, he rightly notes that the magnitude of a hazard cannot be straightforwardly equated with its social impact. Erickson questions the very notion of a collapse and suggests that “culture in Lake Titicaca did not ‘collapse’ after the serious droughts and floods in recent history, nor did it ‘collapse’ in the post-Tiwanaku time. Pre-Columbian states and urban centres were ephemeral, rising and falling with some regularity...” (Erickson 1999, p. 641).

Kolata et al. (2000) have responded to Erickson’s charges of reductionist and deterministic thinking and stress the empirical reality of collapse. This again highlights an ambiguity in the identification of what exactly it is that is collapsing. They point out (Kolata et al. 2000, p. 425) that they never identified, in Erickson’s words, “a total cultural collapse, plunging the Lake Titicaca basin into a post-Tiwanaku ‘Dark Ages’ ” (Erickson 1999, p. 635), nor denied the active adaptive role of people. Kolata (1993, pp. 290–291), in identifying megadrought as “the ultimate threat and proximate cause” of the Tiwanaku state’s collapse, also stated that the process must have taken some generations to work out, and “was accompanied by historically specific instances of social competition, conflict and realignments that are unrecorded in the archaeological record.”

In the case of Tiwanaku, the issue of collapse has clearly been clouded by different interpretations of what is meant by the word, as well as by interpretations

of the scientific evidence and its chronological link with events. Janusek (2004, 2008) has proposed an account of Tiwanaku collapse that integrates the apparent environmental changes with the social and political situation and with collapse as a cultural revolution that was a beginning as well as an end. The collapse combined both political fragmentation and the end of a great tradition that included features of elite culture and urbanization over more than a century (Janusek 2004, p. 202). Tiwanaku collapse “was a dynamic process that resulted in a new and equally significant range of practices and ideals” and was embedded in the development of the Tiwanaku state, which exacerbated existing social tensions (Janusek 2004, p. 176). Yet another model of collapse disputes the idea of gradual change. Owen (2005, p. 74) describes an “explosive” collapse of a state “whose major task was to hold itself together.”

A number of authors also address the post-collapse period. Sims (2006) discusses the formation of the Tumulaca culture in the Moquegua Valley. Tumulaca pottery themes derive from Tiwanaku styles but without elite symbolism such as the Front Face Deity and Puma Head, while Tiwanaku cemeteries, households, and temples also show systematic destruction. Thus, “collapse appears as the transformation of local Tiwanaku groups into an assertive and independent set of Tumulaca communities whose ethnic identity – although derived from Tiwanaku – was founded in a new and independent political organization” (Sims 2006, p. 131). Zovar (2007) similarly notes that collapse and cultural regeneration are intrinsically connected; he also discusses the importance of population movements and interaction in the formation of new identities and the necessity of considering the causes of collapse as factors that extend into post-collapse scenarios. The Inca state also incorporated elements derived from both Wari and Tiwanaku (McEwan 2006). A comprehensive review of the Late Intermediate period that followed Wari and Tiwanaku collapse is given by Covey (2008).

## Ecocide

### *Greenland Norse settlements*

The idea of collapse in Greenland is based on the abandonment of the small but long-lived Viking presence in two settlements (Berglund 1986, 2010; Lynnerup 1996). The western settlement appears to have been abandoned near the end of the 14th century, while the eastern settlement existed for a century longer. The ecocide narrative of collapse focuses on the decisions made by the Norse and their choice of Norse patterns of subsistence and land use in a marginal landscape (McGovern et al. 1988), which are suggested to have resulted in a catastrophic and violent end to the eastern settlement (Diamond 2005, pp. 248–276). In addition to land degradation, which would have reduced the subsistence buffer necessary to survive harder years, other factors in the collapse, such as climate change and the failure of the Norse to embrace Inuit adaptations, are usually cited as key (Barlow et al. 1997; Orlove 2005; Redman 1999, pp. 191–194).

Evidence for a violent end to the settlements is, however, yet to be found; possible evidence of death *in situ* comes from a single farm at Nipaatsog in the

western settlement, abandoned in the 14th century, but no bodies were found (Panagiotakopulu et al. 2007). While there is evidence of land degradation from Norse practices, rising sea levels also may have reduced the amount of land available and the viability of the settlements (Berglund 2010, p. 66). Concerning climate change, McGovern notes (1991, p. 94) that more than coincidence is required for it to be a convincing explanation in itself, although if the onset of the slight cooling of the Little Ice Age between AD 1250 and 1300 did make conditions worse (Redman 1999, p. 191), then this too is a contingent factor. Since the Inuit could survive but the Norse did not, this returns us to the central questions of culture, choice, and (mal)adaptation.

The Norse evidently had some contact with the Inuit over a long period, but unsurprisingly they remained oriented to the Norse culture they were part of and identified with (Gulløv 2008). They were not inflexible or incapable of change; they did adapt to their new environment, replacing metal tools with bone and larger animals and buildings with smaller ones (Berglund 2010, pp. 58–61). Why they did not adopt more Inuit ways is due in part to the desire to retain an existing identity, as well as to socialization and the interpretation of the external world through social and cultural values, which determine acceptable ranges of practice (Friedman 2007, p. 104). Given this, it becomes less appropriate to judge success or failure.

It is difficult to consider the Norse settlements on Greenland as a case of societal collapse or indeed as a “failed experiment” (Redman 1999, p. 191) since the Norse presence lasted almost 500 years. Rather, it seems likely that as the small settlements grew unsustainable in the form desired by their inhabitants and as the unstable climate cooled outmigration occurred over time back into the Norse world (Barlow et al. 1997; Berglund 2010; Buckland et al. 1996; Lynnerup 1996; McGovern 1991).

### *Rapa Nui*

The ecocide narrative of Rapa Nui collapse also identifies a sudden descent into chaos, violence and warfare, and cannibalism caused by overpopulation, deforestation, declining crop yields, and inability to utilize marine resources. Subsistence difficulties and fierce competition brought about sudden depopulation, changing habitation patterns, and sociopolitical change on the island (Diamond 2005, pp. 107–111; Flenley and Bahn 2003).

The ecocide collapse narrative focuses explicitly on the inhabitants’ destruction of the island’s extensive *Jubaea* palm forests (Diamond 1995, 2005; Fagan 2008, p. 176; Mieth and Bork 2010; Ponting 2007, p. 5), an idea that stretches back to French explorer La Pérouse, who visited the island for a day in 1786 (Fischer 2005, pp. 71–72). Islanders chopped down the forests to make rollers to transport the many *moai* and to create agricultural land for an increasing population. This led to soil erosion and declining agricultural output and affected the sources of fresh water on the island. Lack of wood for canoes restricted access to scarce marine food resources; there was no firewood and no chance of leaving the island (Flenley and Bahn 2003, pp. 191–193). Increased competition for limited resources resulted in a “spiral into chaos and cannibalism” (Diamond 1995, p. 63); endemic warfare

ensued, and there was a population crash, often dated to around AD 1680 (Rainbird 2002, p. 439). People began to inhabit caves for protection from conflict, while *mata'a*, bladed weapons, became widespread. As with the Norse in Greenland, the ecocide narrative blames islanders for their failure.

Other authors reject this narrative and question the judgment passed on the islanders. Hunter-Anderson (1998) suggests that forest decline was taking place before human settlement took place, whereas Hunt and Lipo (2010; Hunt 2007) stress the role of rats on impeding forest regeneration (see also Mann et al. 2008; Mieth and Bork 2010; Rainbird 2002). Climate change also has been identified as a cause of deforestation (Nunn 2000; Nunn et al. 2007), although the association of an AD 1300 climate event with changes in cooking around AD 1650 and other events culminating some three centuries later seems a stretch (Hunt 2007; Mieth and Bork 2010); the AD 1300 event itself remains hypothetical (Allen 2006, p. 527). Long-term survival of many species of plants and animals suggests that climate change itself may have had little effect on the island's ecology (Diamond 2005, p. 114), but this depends on the specific characteristics of the paleoenvironment. It seems that some tree species survived into the 20th century (Anderson 2002, p. 383). A recent review, in fact, questions the long-standing interpretations of paleoenvironmental evidence taken to suggest that Rapa Nui was a forested island when settled and suggests that a number of reconstructions are possible (Rull et al. 2010). In any case, ecological changes appear to have taken place over several centuries, with islanders adapting to them (Rainbird 2002).

While ecological, political, and cultural changes occurred on Rapa Nui, demonstrated by an apparent shift from *moai* construction and erection to toppling, they have been tied by some to the period of European contact rather than earlier (Fischer 2005; Hunt 2007; Hunt and Lipo 2010; Rainbird 2002). Anderson (2002, p. 382) also suggests that statue toppling was practiced throughout Rapa Nui history, with widespread toppling in the late 18th century. No *moai* were reported as toppled by Roggeveen in 1722 or de Haedo in 1770, but Cook in 1774 reported fallen statues, and none were standing by the 1860s (Fischer 2005, pp. 64–66). Evidently, these changes played out over a long period as groups on the island continued to compete with each other. Although new *moai* were not constructed, presumably because of the lack of tress, the toppling shows their continued cultural relevance into the contact period. In terms of subsistence, Rapa Nui's productivity was observed by Roggeveen and others (Peiser 2005, pp. 520–521), although the island may have suffered periodic shortages. Whether cannibalism was ever really practiced is uncertain; there is no positive archaeological evidence for it and no evidence that it became a subsistence practice (Fischer 2005, p. 55; Flenley and Bahn 2003, p. 156). Driftwood certainly was valued, and islanders used it to construct canoes; bundles of reeds were also used to create floats (Fischer 2005, pp. 47–49).

The notion that there was a drastic population collapse related to environmental collapse assumes that the Rapa Nui population increased to unsustainable levels that made the society vulnerable to stress (Hunt 2007; Hunt and Lipo 2010; Peiser 2005). Diamond (1995) thought a population maximum of up to 20,000 was not unreasonable but noted estimates of 6,000–30,000 (Diamond 2005, p. 90). Fagan (2008, p. 176) suggested a possible peak population of 15,000 in AD 1600, which

collapsed during the 1700s, whereas Fischer (2005, p. 45) suggested 12,000 in the 14th or 15th century, which halved before European contact. Hunt and Lipo (2010, pp. 38–39) and Peiser (2005, p. 532) emphasize that such numbers are largely guesswork and that the number of habitation sites declined only after European contact.

Anderson notes (2002, p. 383) that warfare was common on Polynesian islands and does not indicate demographic collapse. Evidence for massive population decline is only securely situated in the contact era of the 18th and 19th centuries in connection with introduced diseases and blackbirding (Hunt and Lipo 2010; Peiser 2005; Rainbird 2002). Fischer states that it was between 1862 and 1871 that 94% of the surviving population either perished or emigrated, and that “in blood and anguish...ancient Easter Island crumbled...” (Fischer 2005, p. 86). In surviving to the present, the Rapa Nui have shown remarkable resilience, mainly in the face of contact with outsiders.

The case of Rapa Nui is one of the best-known examples of supposed collapse by overshoot; it is a key component in a number of narratives that have an explicitly moralizing tone and that seek to condemn unsustainable or environmentally damaging practices in the contemporary world (Bahn and Flenley 1992; Diamond 1995, 2005, pp. 79–119; Ponting 2007, pp. 1–7; Redman 1999, pp. 7–11). As Peiser remarks, “[it] is the poster child of a new environmentalist historiography” (Peiser 2005, p. 513). But this example and that of the Greenland Norse are not, in fact, clear cases of collapse. The use of a version of Rapa Nui history that emphasizes the islanders’ “failure,” based on fragments of evidence constructed to a modern paradigm rather than the realities of the contact period, seems to be another theft of history (Goody 2006).

## Catastrophism

### *Palatial (Minoan) Crete*

Collapse at the end of the Neopalatial period—defined as Middle Minoan III until the end of Late Minoan IB, perhaps some 250 years to c. 1450 BC (but see Bruins 2010; Dickinson *in press*; Manning 2010; Manning et al. 2006; Ramsey et al. 2010)—is identified by the end of a palace-based culture that used Linear A script and the integrated islandwide system that had developed over time (Davis 2008; Manning 2008; Schoep 2010; Tomkins and Schoep 2010), perhaps with some form of Knossian pre-eminence (Bevan 2010). This was accompanied by widespread but selective destruction by fire, abandonments, deurbanization, and possible depopulation (Hallager 2010, p. 153).

Two long-standing hypotheses associate the collapse of Neopalatial society on Crete with the eruption of Thera. Marinatos (1939) saw the eruption itself as destroying the palaces, but it later became clear during excavation of Thera that this was not possible since the eruption took place perhaps some 30–50 years earlier, in LM 1A (Keller 1980; Pichler and Schiering 1977). Other arguments associate the eruption and its possible effects—earthquakes, ashfall, and tsunamis—with the collapse (Antonopoulos 1992; de Boer and Sanders 2002; Luce and Bolton 1976;

McCoy and Heiken 2000; Monaco and Tortorici 2004). These mechanistic arguments, however, have been doubted and disproved. While Bruins et al. (2008) and others suggested that a tsunami would have destroyed Cretan naval defenses and allowed invasion, purported Mycenaean influence, whatever that is, only becomes more apparent later. Minoura et al. (2000) conclude that tsunami waves, while affecting Aegean and northern Cretan coastlines, would have had little influence on Neopalatial Cretan society. In fact, Bruins et al. (2008) note the rebuilding in fine masonry at Palaikastro, and others emphasize that in LM IB Crete maintained its Aegean and international contacts and regained its prosperity (Davis 2008; Hallager 2010).

Driessen and MacDonald (1997, 2000; Driessen 2001) also doubt that the Thera eruption was the direct cause of the collapse of Minoan Crete in a purely mechanical sense. They, too, argue that there was reconstruction but also that numerous changes in the archaeological record reflect the actual and psychological impacts of the eruption and its effects. Economic dislocation and a loss of faith in the established order based on the palaces are reflected in architectural changes that restricted access and increased local storage facilities (Driessen and MacDonald 2000). They further suggest that existing social tensions would have been exacerbated and that a period of conflict ensued, reflected in the widespread but selective destructions visible in LM IB and the end of regional Cretan influence.

Although catastrophic explanations tend to be unpopular, and Driessen and MacDonald's narrative is not universally accepted, it does at least benefit from their attempt to integrate and explain archaeological change through reference to demonstrated patterns of social behavior known to occur in response to such events. While avoiding mechanical determinism, it also suggests that collapse may occur for contingent reasons.

This collapse is distinguished from what happened after Late Minoan IB (to LM IIIA2 Early, perhaps around c. 1300 BC). While Tsonis et al. (2010) suggest that climate change prevented Cretans from regenerating their complex society after the Neopalatial collapse, this deterministic view is not borne out by the admittedly confusing picture of Crete after LM IB. It seems that there was a re-emergence of elites at Knossos, which became the only functioning palace, and later at formerly important Neopalatial centers around Crete, although there is little general evidence of administration (Hallager 2010, p. 154; Preston 2008, pp. 316–318). The notion of an organized Mycenaean invasion is now doubted, and an emergent and powerful elite at Knossos can be recognized through its use of Linear B and reuse of some traditional Cretan symbols of power (Driessen and Langohr 2007).

Whether they were a small group of mainland "Mycenaeans" or "Minoans" adopting a new imagery of power oriented to the mainland is unclear; there are mainland elite features in burials combined with Minoan symbols. It is in any case questionable to assign meaningful ethnic identities to groups represented by archaeological assemblages (Preston 2008, p. 316). Although the dating of the Linear B tablets from Knossos and the date of the final destruction of the Knossos palace are disputed (Driessen and Langohr 2007, pp. 179–180; MacDonald 2010), survey reveals very limited evidence for activity during LM IIIB. The site seems to have lost importance in the 13th century BC, not regaining it again until after 1200

BC in very different circumstances; power may have been constantly shifting between centers throughout this period (Preston 2008, p. 317). Linear B was used in Chania in LM IIIB, and it may have been a palatial center, but main sites again suffered destruction and abandonment by the end of that period. Widespread settlement redistribution seems to have occurred at the end of LM IIIB (Nowicki 2000; Wallace 2006, 2010).

### *Late Bronze Age (Mycenaean) Greece*

This collapse is identified by a series of destructions of major centers and palaces, taking place over perhaps a few decades around c. 1200 BC, which appear to indicate the end of Mycenaean states (Bennet 2007; Deger-Jalkotzy 2008; Dickinson 2006a, 2010; Middleton 2010). Linear B writing was no longer used and monumental building ceased, among other visible changes particularly related to elite culture (Rutter 1992). Many smaller sites were abandoned, a trend particularly noticeable in Messenia, although there may be problems with the visibility of evidence. Some areas that had not had palace states, such as the northwestern Peloponnese, appear well populated, and some movements of people from palatial areas after 1200 BC is possible, although the nature of such movements is disputed (Iacovou 2008; Middleton 2010, pp. 68–91; Yasur-Landau 2010). Local and overseas trade and contact appear to have continued but on a reduced scale.

A recent trend in explaining the collapse of Late Bronze Age society in Greece, and in the eastern Mediterranean more widely, relies on catastrophic seismic events as a cause. Greece and the eastern Mediterranean are areas of high seismic activity, which has caused periodic destruction throughout history (Stiros and Jones 1996). The use of the earthquake hypothesis to explain collapse is not new; Schaeffer (1948) suggested that Ugarit and other sites were destroyed by seismic activity. The fact that these widespread destructions took place over a multidecadal period was problematic, and his theory was discredited (Nur and Burgess 2008, p. 238). Kilian (1996) also associated earthquakes with changes in material culture at Late Bronze Age Tiryns and extended this to the wider collapse of the Late Bronze Age palace states. At Mycenae, French (1996, 1998, 1999, 2002) accepts that earthquakes periodically affected the site, but she seems more skeptical about the wider effects.

Recently, Nur and colleagues have surveyed archaeological evidence from a wide range of sites and suggest that an earthquake storm—a series of connected earthquakes that can occur over decades—could have caused many of the destructions (Nur 1998; Nur and Burgess 2008; Nur and Cline 2000). A similar but even longer earthquake storm, punctuated by the possibly exceptionally severe AD 365 Crete earthquake, is suspected to have affected Crete and the eastern Mediterranean between the fourth and sixth centuries AD (Stiros 2001; but see Kelly 2004). According to contemporary sources, the AD 365 earthquake destroyed more than one hundred towns on Crete and caused a tsunami that flooded Alexandria and other places (Shaw et al. 2008).

Initially, Nur and Cline (2000, p. 61) were tentative in their claims and held back from assigning all site damage and collapse between c. 1225 and 1175 BC to

earthquakes. More recently, however, Nur and Burgess (2008) have made a stronger argument for their earthquake storm, but this has been met with some skepticism (Stewart 2008). In his review, Stiros (2009) notes the problem of assigning particular kinds of evidence, such as unburied skeletons and architectural damage, securely to earthquakes, similarly noted by Ambraseys (2005, 2006), who also observed that well-known earthquakes in the eastern Mediterranean seem to have had relatively few long-term social effects.

A number of recent overviews also question why earthquakes at 1200 BC would result in collapse, given that earlier earthquakes had not (Deger-Jalkotzy 2008, p. 391; Dickinson 2006a, p. 46; Drews 1993, pp. 33–47; Shelmerdine 2001, p. 375). French has suggested that “the bureaucratic administration which had been fully stretched to deal with the expansion of the first half of the century followed so soon by a devastating earthquake was not able to cope with another disaster on this scale” (French 2002, p. 135). Thus it was the economic effect of several disasters over time on an already overstretched economy, possibly suffering from reduced trade and a lack of raw materials, that brought about the end of the Mycenae kingdom (French 2002, p. 135). This reinforces the point made by Williams (2002, p. 372) that the link between the magnitude of a natural disaster and its social effects is not clear-cut.

Physical destruction then cannot fully explain the collapse of the palace system itself and the rejection of the symbols associated with it. Other explanations emphasize possible increases in regional and local conflict and instability (Dickinson 2006a, pp. 54–56), shifting trade routes or economics (Sherratt 2001, 2003), or a failure of the eastern Mediterranean system as a whole (Bachhuber and Roberts 2009; Betancourt 2000; Bryce 2005a, b; Drews 1993, 2000; Parkinson and Galaty 2009; Popham 1994; Stiebing 1980; Van de Mieroop 2010, pp. 235–253).

Despite popular representations of this collapse as resulting in a “dark age,” the Postpalatial period saw the continuity of Mycenaean culture for some century and a half after 1200 BC before a new material culture became widespread. Yet there was more visible regionalism and no indications of complexity to match the regional states of the palatial period (Dickinson 2006b; Eder and Jung 2005; Iakovidis 1970; Lemos 2002; I. Morris 2006; Rystedt 1999). Mycenaean society was, in fact, never all “palatial,” even before the collapse (Middleton 2010; Tartaron 2010; Wallace 2006).

It is even possible to detect a rich Postpalatial culture, especially phase LH IIIC Middle (Thomatos 2006). At Tiryns there were concerted efforts to reuse the area of the former palace, although the nature of this reuse demonstrates a selective use of the past. These may reflect ideological shifts away from a single ruler to a more oligarchical system (Maran 2001, 2002, 2006). At Mycenae too, French notes (2009) that continued evidence of town planning after c. 1200 BC indicates the presence of some kind of authority and suggests that this authority may have been “palatial” despite the physical changes that lead us to term the period Postpalatial. This is salutary: a continuation of the same authority in a new guise would be difficult to detect archaeologically.

Smaller sites such as Mitrou and Lefkandi in the Euboean Gulf also continue into the Postpalatial period and later and may be important sites for local elites

(Crielaard 2006; Kramer-Hajos and O’Neill 2008; Sherratt 2006; van de Moortel and Zahou 2005). The northwest Peloponnese and Ionian islands also had a vibrant culture at that time (Eder 2006). Whatever Mycenaean fragments may be found in myth (Sherratt 1990), later Greek society seems to have preserved no clear memory and little heritage from the Mycenaean palaces; rather it had origins in these Early Iron Age cultures (Dickinson 2006b).

## Final comments

This review has demonstrated some of the ways that the language of collapse is used to describe quite different types of change among a number of different units of study. The lack of clarity with which these terms are used often creates confusion and mixed messages about collapse. The language also betrays more or less implicit biases or judgments about what kind of situation might be assumed to be better. I have also considered some of the problems and oversimplifications evident in the way that some apply environmental approaches to explaining collapse.

The view that collapse is a phenomenon simply determined by unexpected environmental or climatic shifts, resource degradation, and maladaptation fails to recognize that reactions to problems and challenges of all kinds are not simple cause and effect; rather they are bound up with and refracted by social realities, priorities, and motivations that may be far from unified or singular. Many collapses may be best seen as representing the consequences of conflicts between and within groups, which led to the materially visible changes that we identify in the archaeological record. Those conflicts may have been triggered or exacerbated by a wide range of both internal and external causes with unpredictable consequences. Whether such times were “good” or “bad” for participants very much depends on the perspective taken; most likely they were both or neither.

This review also shows that any discussion of past collapse must be based ultimately on dynamic bodies of evidence, theory, and interpretation. What seemed like sudden and devastating events to archaeologists some time ago can evidently resolve into more complex and longer-term processes as further research that changes the patterns being explained is undertaken. There is often a desire to weave together a plausible narrative or see new evidence as providing a solution, but interpretation is always subject to questioning and revision. Sometimes it would be better to acknowledge doubt more clearly when there is in fact little evidence, or when it is difficult to interpret or otherwise ambiguous.

Collapse clearly is a lively field for archaeological (and cross-disciplinary) research. Comparison of different cases can be fruitful in that we find similar problems with evidence, chronology, and explanatory discourse. It also shows that episodes of collapse share a connection to the notion of shared ideas and identities at the heart of social groups. This recognition of the fluidity and constant renegotiation of such bonds within the competitive arena of human social systems has led to an increased focus on what happens in the wake of collapse, including the regeneration of complex society that may or may not incorporate elements of previous systems in the construction of new ones (Schwartz and Nichols 2006).

In many instances of collapse, in Teotihuacan, Tiwanaku, the Classic Maya, Late Bronze Age Greece, and others, the ideological elements of elite cultures are selectively rejected or abandoned and often accompany changes in how people are spread across the landscape. This suggests that many ancient polities were fragile entities that represented attempts at binding together different groups into bigger systems that were prone to collapse (Milner 1990, pp. 29–32; Sherratt 2001). What we see of them materially often represents the parts of systems that served the interests of dominant elites and that were employed to reify their power. Other features that change in collapse, particular settlement patterns and sometimes more dense or higher populations, were probably in some sense dependent on the temporary conditions created by these integrative attempts.

Concern over the sustainability of today's societies and systems in the face of climate change and environmental degradation is one reason to study examples of past collapse and social transformation, but there should be a clear message that these are not usually the sole or simple mechanical causes of such change. At the time of writing, a number of Arab states (Tunisia, Egypt, and Libya) are experiencing revolutionary political change (and in Libya, a mass exodus, food shortages, and humanitarian crises); this is a timely reminder that changing relationships within communities and the dynamic utility and value of social systems as means of mediating interactions themselves cause change. These events can be situated and understood in wider contexts, but equally they have occurred suddenly and unpredictably, and have uncertain long-term consequences.

A rich consideration of sustainability as applied to human communities equates to much more than merely paying attention to climate change, subsistence, or resource concerns, but also to matters of social justice, participation, and exclusion, and must reflect human social interactions that are played out against a dynamic backdrop. As Redman suggests of the Mesopotamian Ur III dynasty: "State ideologies assumed at that time, as do many today, that everyone's interests are served when the interests of central rulers are served. Clearly, however, most people may not share the rulers' objectives and not every segment of society is likely to benefit equally from a particular productive strategy" (Redman 2004, p. 162). The potential social, political, and economic consequences of such situations are plain to see.

**Acknowledgments** I thank Gary Feinman, George Cowgill, Oliver Dickinson, Linda Nicholas, and the six anonymous reviewers for their constructive criticism and numerous suggestions, all of which have improved this article. I am also grateful to Halvard Buhaug, Mike Charles, Elizabeth French, Mark Geller, Maria Iacovou, Jane Rempel, and Tom Tartaron, who kindly sent me copies of their work, and to Peter Robinson who discussed an early draft.

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