

RISING TIDE

MELTING ICE

preservation of world archaeological heritage in a time of climate change



journalist Andrew Curry and archaeologist Wouter Gheyle
in conversation with May Cassar,
director of UCL's Institute for Sustainable Heritage



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Global weather patterns are changing and with these changes come significant threats to the preservation of world archaeological heritage. An increasing number of coastal sites are vulnerable to inundation and ruin by rising sea levels. And as temperatures rise in some parts of the world those archaeological remains which have laid frozen in the permafrost, in a state of spectacular preservation, are beginning to thaw...and rot. The need to raise awareness of how global climate change is affecting archaeological heritage is clear and the timeframe left to us to address this challenge is growing ever shorter. From Easter Island to the Altai Mountains, archaeological sites are increasingly at risk due to changing weather patterns and climate shifts.

Following from the IIC 2008 Dialogue on Climate Change and Conservation, this panel discussion focuses on specific case studies and their relationship to the broader challenges being faced by the preservation community in a world of shifting climates.

Panel members:

Andrew Curry is a contributing editor at ARCHAEOLOGY and has written extensively on the effect climate change is having on cultural heritage. He has written and edited for Archaeology Magazine, The Christian Science Monitor, Discover Magazine, National Geographic, The New Republic, Science, Smithsonian Magazine, The Washington Post, Wired and Wired News among other periodicals. Andrew Curry was a Fulbright Journalism Fellow; he received the Arthur F. Burns Journalism Prize in 2008; the 21st Century Trust Fellow, Rostock, Germany in 2007; and was named a Fulbright Guest Lecturer, University of Leipzig in 2006.

Wouter Gheyle studied archaeology at Ghent University where he received his Master's degree in 2002 and his PhD in 2009. He has been working as a scientific researcher at Ghent University since 2003. His main interest is in the archaeology of the nomadic cultures of the Eurasian steppes, with a focus on the Altay Mountains. His research from 2003 to 2009 was with a UNESCO/Flanders Funds-in-Trust project concerning the Preservation of the Frozen Tombs of the Altay Mountains. Currently he is working on a project that involves the in-depth study of the Iron-Age population in Altay.

May Cassar is Professor of Sustainable Heritage at UCL and Director of the Centre for Sustainable Heritage, which she set up at the Bartlett School of Graduate Studies (BSGS) in 2001 when she joined UCL. She leads the Heritage Research Group within the Complex Built Environment Systems research area at BSGS and has overall responsibility for research, teaching and consultancy in sustainable heritage. May has a national role as a member of the Science and Research Advisory Committee of the Department of Culture, Media and Sport and as the Director of the AHRC/EPSRC Science and Heritage Research Programme, and has an international role as a member of the European Union External Advisory Group for the RTD Theme, Environment (including Climate Change) and as a member of the Executive Board of the EU Joint Programming Initiative on 'Cultural Heritage and Global Change'

May Cassar

The Topic

I'd like to welcome you all to UCL and to the Centre for Sustainable Heritage whose 10th Anniversary we are celebrating this year. We are honoured to be partnering IIC in this event, Rising Tide/Melting Ice. Climate change impact on cultural heritage is one of our research priorities. It was a project we did for English Heritage in 2001 that first drew attention to how climate change might affect not only immovable heritage, which is archaeology and buildings, but also collections. I am delighted to be able to moderate this conversation. My role is going to be in the background to ensure that the two panellists that we have here this evening, Andrew Curry who is the contributing editor of Archaeology magazine and Wouter Gheyle from the University of Gent, who is a scientific researcher, and archaeologist, and who has worked on the frozen tombs in the Altai region, will have every opportunity to converse. Both will have the opportunity to raise our awareness about some of the issues that are facing archaeology in this time of climate change. And indeed archaeology is being pressed on a number of fronts. Today we're going to be looking at the effects of rising tides and coastal erosion on the one hand but also the melting of ice, particularly permafrost, and all the implications for what we can do in the short time that we have available to take preservation action. So here are two manifestations of the preservation issue we intend to raise awareness of. But this is also about sharing knowledge, which we will do led by the two panellists. We want to explore...have a dialogue...about what can be done as we increasingly lose cultural heritage due to changing global climate conditions.

This loss is not going to be a slow process. And action is required of us. So without further ado I'll hand the podium over to our first panellist, Andrew Curry. He will be followed by Wouter Gheyle who will also be giving a short introductory presentation. Following that we will engage in a dialogue and see where that takes us with questions and answers.

Andrew Curry

Rising Tide

I want to start with a general overview of the problem as I see it. I was talking to my fellow panellist before we began this program and I found out that he is a relatively new father. While this is exciting and congratulations are in order, I want to note that within his daughter's lifetime, in 2100, which is less than 90 years away, sea levels may well rise by a full 2 meters. The current predictions are that global temperatures could rise between 2°C and 4°C. This could mean a sea level rise of between 60 cm and 200 cm. As a result sites all around the world, from our coasts to inland sites, which is what Wouter specializes in, are in serious danger. Let's just go through some of the sites that might be affected. These span an incredible range of archaeological interest, human history and human prehistory.

One of the oldest sites in the world is Pinnacle Point in South Africa. It is located at the very southern tip of South Africa. The site is one of the earliest settlements of early modern humans. Much of the many new discoveries and the information regarding human origins have come from Pinnacle Point.

These are caves that are at, or very close to, sea level. All are eroding very quickly as get increased wave action and increasing sea level rise rather quickly destroy them.

Gorham's Cave at Gibraltar, a similar site to Pinnacle Point, which is famous for having the last traces of Neanderthal presence in Europe. Is also in danger. At this site 120,000 years of human history is being eroded away by the Mediterranean, and rapidly.

The story is similar in the United States, California Channel Islands. John Erlandson, a researcher from the University of Oregon, is concerned about a 16,000 year old midden (similar to a trash pile), on Santa Rosa Island. The midden was, in ancient times, 5 km from the sea but today Erlandson found these Barb points, essentially harpoon tips, just walking along the beach because the water is coming directly into what used to be 90 feet above water and 5 to 7 km inland. The midden is now in great danger of being lost. That sea level rise has happened over a period of 16,000 years but in the last 100 years we have had 17 cm of sea level rise and the rate of sea level rise has doubled in the last 10 years alone. This is expected to continue, not exponentially, but rapidly.

A researcher at the Danish National Museum works in Greenland on Thule sites that date back about 3000 years. The site is called Dead Man's Bay. When it was first excavated 80 years ago about 40 houses were found that had been built by some of the earliest people to live in Greenland. Over the last 80 years 10 meters of the shoreline has been lost. This is not gentle erosion. In fact in 100 years this site will be the subject of underwater archaeology. The problem presented by this is not exactly sea level rise but rather that Greenland had a shell of what is called "sea ice". This is composed of packs of ice off the coast which sheltered Greenland's coastline from heavy wave action, storms and the high tides of winter. That sea ice has all but disappeared which means that much more wave action and much stronger storms have much greater impact. The last time this researcher was in Greenland was in 2008 and studying these archaeological sites had become a problem because the waves were too strong to even get their boats up on the beach. It has only gotten worse since then.

From the southern tip of Africa to as far north as you can go the geography of human habitation is at risk.

Archaeologists in Florida, Louisiana, and Mississippi estimate that the three or four days of heavy storms during Hurricane Katrina in 2005 caused over 1000 archaeological sites on the Florida coast and up along the Gulf of Mexico to be washed into the sea. Those were sites from the earliest periods of habitation in the Americas. This includes sites that were important to Spanish colonial history as well as American colonial and postcolonial history. A real wealth of information has been lost. Katrina was a warning signal.

Something that scientists have been saying about climate change for some time is that it is not just the slow rise in sea level but it's also a process by which familiar weather patterns become more and more

extreme, and unfamiliar. Hotter climates and severe droughts; eventual desertification of places that are only moderately hot today; and places where there is moderate rain fall will become places that experience torrential rain and flooding as well as a dramatic increase in the number of four and five level hurricanes. This is because the speed at which the Earth is warming alters weather patterns and makes things more dramatic. And it is these really severe weather events that pose a significant threat to coastal archaeology.

Musawwarat es Sufra is a site where German archaeologists from Humboldt University excavated in the 1960's and as an aside I hope we can talk about the pros and cons of excavation a bit later. The German archaeologists excavated a complex of temples, each with really beautiful and intricate sandstone carvings that had been done at a time when the landscape was grassland. Now these temples exist in a completely barren landscape because in the last century or two the grasslands have completely disappeared. What you have now is essentially the Sahara sands blowing straight down onto the region. After excavating the site and reconstructing it, making it visible and understandable as temples, the Humboldt University archaeologists regretted their excavation because the carvings were being quickly eroded away by blowing sand storms. The suddenly exposed soft sandstone is eroding quickly and no one seems to really know what to do.

Increasing desertification caused by climate change and because of human action like over cultivation of the land, or draining of the water tables, is getting more serious in Africa and elsewhere in the world.

Skara Brae is a site on the Orkney Islands just west of England, it is 5000 to 6000 years old and with extraordinary preservation of houses that were built 3 or 4 meters underground. You can go down into these houses and see the beds, the fireplaces, the perfect stone walls, all incredibly well preserved. When they discovered the site the sea was not immediately right next to it and now it is. They had to build a 4 meter high reinforced concrete wall immediately next to these 6000-year-old buried houses. And over time they had to add to the wall to assure that it went all the way down to the bedrock because the ocean water was coming up underneath the foundations. Three years ago they had a severe storm and part of the wall collapsed. It seems to be a losing battle.

You can, however, find positive stories. Starting in 1996 a group called SCAPE (Scottish Coastland Archaeological Preservation Enterprise) has focused on finding what archaeological heritage exists by using aerial and ground surveys to map as much of Scotland's coastline as they can. They have managed one third of it in the last 16 years. There's a lot of work yet to do in Scotland and indeed in the rest of the world. These surveys have uncovered a tremendous amount of new material and they've only been able to excavate a handful of places because excavations take a lot of time, money and other resources. The Scottish archaeologists' focus on the most threatened early sites such as salt pounds and industrial sites. But they have also seen a good deal of archaeological resources washed into the sea.

Cape Hatteras has an astonishing lighthouse that was built in 1870. Cape Hatteras is not incredibly ancient but is historic and although the United States has many lighthouses this one is a distinctive part of the North Carolina coastline. \$12 million was raised to move the lighthouse 870 meters inland, to save it. Imagine however what \$12 million could do for simply surveying of archaeological resources that

are at risk. Cape Hatters is safe for now. But a lot of the beach has already been washed away. Perhaps with the right effort there is a way to get this kind of initiative enacted for other archaeological resources as well.

I understand that a lot of things the IIC does have to do with the built environment and collections. I was recently at a set of painted wooden churches in Romania. They were painted 500 years ago. Fairly recently these paintings started to disappear rather quickly because the immediate environment has gotten a lot wetter and destructive microclimates have been developed around these buildings. Climate change does not just affect archaeology, it affects everything. And it's not just rising seas but it's also melting ice and with that I will now invite Wouter to the podium.

Wouter Gheyle

Melting Ice

I am going to take you to the Altai Mountains, in South Siberia, on the border between China and Mongolia, Russia and Kazakhstan. I've been fortunate to work there for over nine years. It is where I study archaeological landscapes. In the Altai we have the problem of frozen tombs that are preserved in permafrost conditions, but which are now threatened by global warming, they are thawing.



Wouter FIG 1. Altai Mountains, Yustyd Valley, with several archaeological monuments on the foreground.

Frozen heritage and frozen archaeology is mostly about preserved organic materials: leather, textiles and many other kinds of organic materials. Once it is no longer frozen you really have very little left and what is left decays very rapidly. So it is like a 0-1 situation. A negative-positive situation. And perhaps most importantly, if it goes badly, it is irreversible.

Excellent preservation of organic materials, which you all know very well, is provided by conditions that are either very dry or very wet, very cold, very salty, or because there has been a specific treatment like mummification employed, or a combination of all of these factors.

I am here to talk about frozen conditions. These conditions occur in the cryosphere, which is a big part of our world. It is made up of snow, river and lake ice, sea ice, glaciers, ice caps and ice shelves, and frozen ground, both permanently frozen and seasonally frozen.

It is astonishing what can be found in these frozen conditions. Much of the organic material is essentially "freeze-dried". And it is often perfectly preserved, even over 500 years, like the finds in Greenland, the Inca burials from the Andes mountains or the accidental finds on glaciers (see Dickson 2012 for an overview). The latter finds are due to the movement and the melting of glaciers which expose archaeological finds like Ötzi, or the Iceman, which is 5,300 years old and perfectly preserved. Recent historical remains can also be found like the remains of the mountaineer Norbert Mattersberger, only 150 years old.

I can speak more directly to the frozen tombs of the Scythians in Altai, which are preserved completely, including burial chamber and grave contents. Many of these have been frozen for over 2,500 years. My experience is with the archaeological remains from the Altai, but there are other ice mummies. Like the unfortunate explorers and sailors from several Arctic expeditions that occasionally have been found.

The condition of these finds is almost always spectacular. The next example is a 500-year-old girl found in one of the highest volcanoes of Argentina, the Lullullaico.

And this is Ötzi, the Iceman, as he was found on top of a glacier. His skin is perfectly intact and preserves the tattoos on his back. All of his clothing and gear was found on the glacier in the years after his recovery, which allowed a very detailed reconstruction of his last days in the mountains.

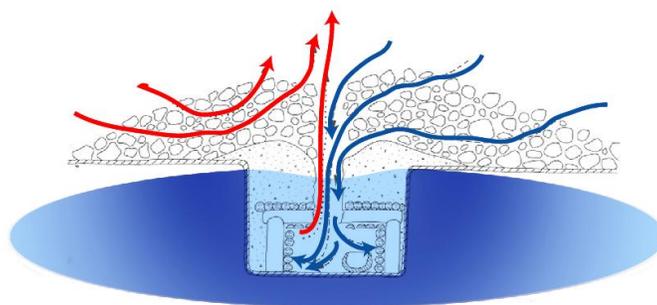
There is a relatively new research topic in Scandinavia, Alaska (Yukon), the Rocky Mountains and other Alpine regions, which is snow patch or ice patch archaeology (e.g. Callanan 2010). This is when small ice patches or snow patches melt and reveal archaeological finds. It is interesting to note that the snow and ice patches remain intact even throughout the summer. Reindeer will often gather on top of the ice to rest and avoid mosquitoes. As today's hunters, early man observed this and took advantage of the situation. As a result there is a great deal of evidence for hunting activity around these patches. And now, with melting caused by global climate change, one finds a great deal of organic remains from hunting activity along the receding edges of these patches; arrows, bows, and other hunting equipment. In the beginning of these discoveries archaeologists found hunting gear that was 500 years old. But now they have found hunting gear that is around 2500 years old.

There are a great many of these ice patches and many of them are receding and melting. As a result archaeological activity is increasing dramatically, with cataloguing and GPS surveying. Monitoring indicates that the ice patches are definitely melting and disappearing.

In the Altai Mountains we have hundreds of these frozen and well preserved sites. Some are located lower in the mountains and they have a very specific construction. And, perhaps by accident, the construction of the mounds, which allows the cold air to enter during the wintertime and keeps the grave cool in the summer time, reduces the interior temperature to the point where the ground below the mound is frozen, creating a kind of ice lens under the mound. The result is a big mound of stones that is covering a frozen and well preserved grave of first millennium BC, even though the surrounding area has temperatures above zero (Bourgeois *et al.* 2007).



Wouter FIG 2. An example of a stone burial mound in the Altai Mountains.



Wouter FIG 3. An ice lens forming under the burial mound because of the cooling effect of coarse debris.

The level of preservation is really impressive. You have the wood construction of the tomb and the sarcophagus (sometimes filled with ice) with the frozen mummy. There are textiles, carpets, clothing, a variety of felt and wood decorations, leather and, of course, the bodies themselves. The Scythians had a tradition of mummification. Each body was cleaned, eviscerated and then sewn up. But of course this mummification process would not have been successful without the freezing temperatures. One of the most famous tombs is that of the "Ice Princess", at the site of Ak-Alakha on the Russian Ukok Plateau. The site was excavated in 1993 and produced evidence of the long Scythian tradition of body tattooing and decoration (Polosmak 1994).

Imagine that this subtle equilibrium between freezing and thawing is disrupted by a rise of 2 to 4 °C. Such a disruption would result in the complete destruction of every one of these tombs, none would survive, except for some tombs that are really high up in the mountains.

Investigations have observed the partial melting of the permafrost and the resulting deterioration of the burial and its contents. For example in the burial mound of Berel in Kazakhstan, which included all of the typical decorative elements, only the frozen bodies of the horses have remained intact while the surrounding tomb and organic grave goods were completely deteriorated and lost.

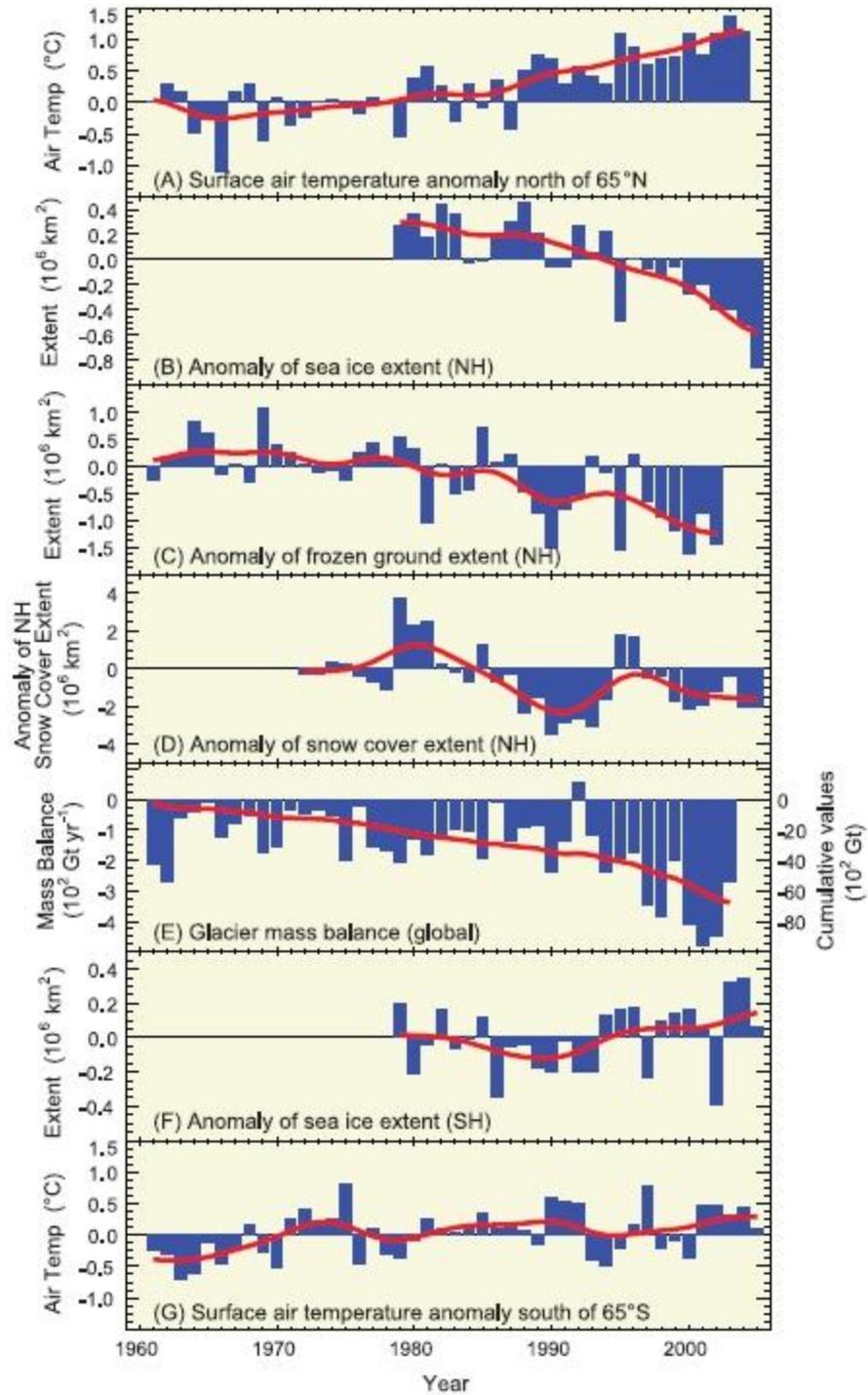


Wouter FIG 4. Decorated horse gear from the burial mound in Berel, Kazakh Altai (Excavations by H.-P. Francfort and Z. Samashev, reconstruction by K. Altynbekov).

This subtle equilibrium is especially fragile in the Altai, which is located on the very edge of the large continental permafrost area of Siberia. Here, at the edge, there are only scattered and discontinuous patches of permafrost. Higher in the mountain there is more stable permafrost, but in the lower valleys it's a very unstable and vulnerable to even minor temperature rise. There have been a great many temperature changes in the last 50 to 100 years. High alpine environments are very sensitive to temperature change and ice is a very good indicator of all of these changes. What we see is that the glaciers are melting very, very quickly. They have lost 27% of their ice mass in just the last 50 years alone. It's a huge change.



Wouter FIG 5. The Altai Mountains on the periphery of the continental Siberian permafrost area, with sporadic permafrost with a maximum thickness of 25 metres.

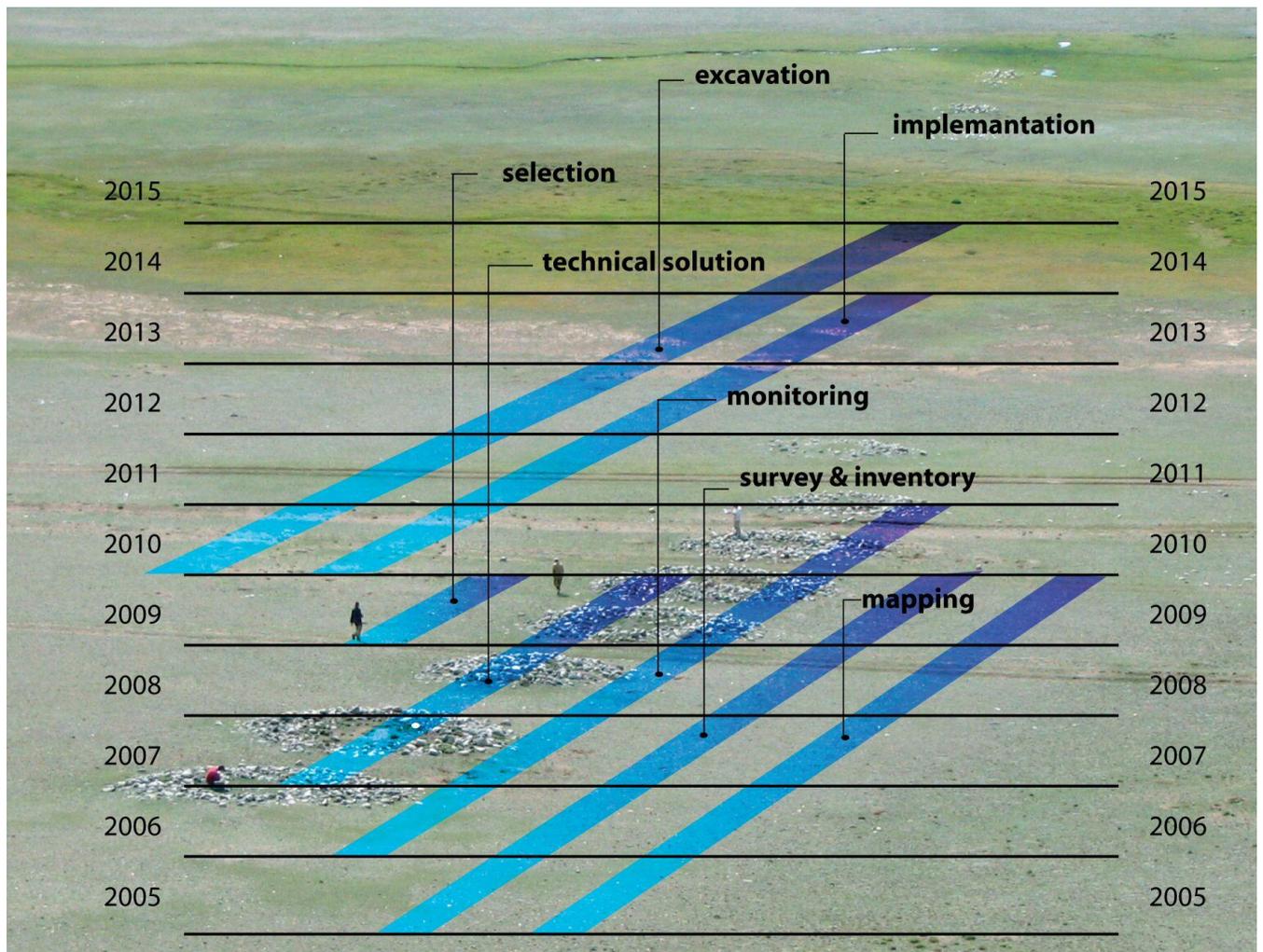


Wouter FIG 6. Global cryosphere time series showing air temperature, sea ice extent, frozen ground extent, snow cover extent and glacier mass balance (taken from IPCC 2007 report)

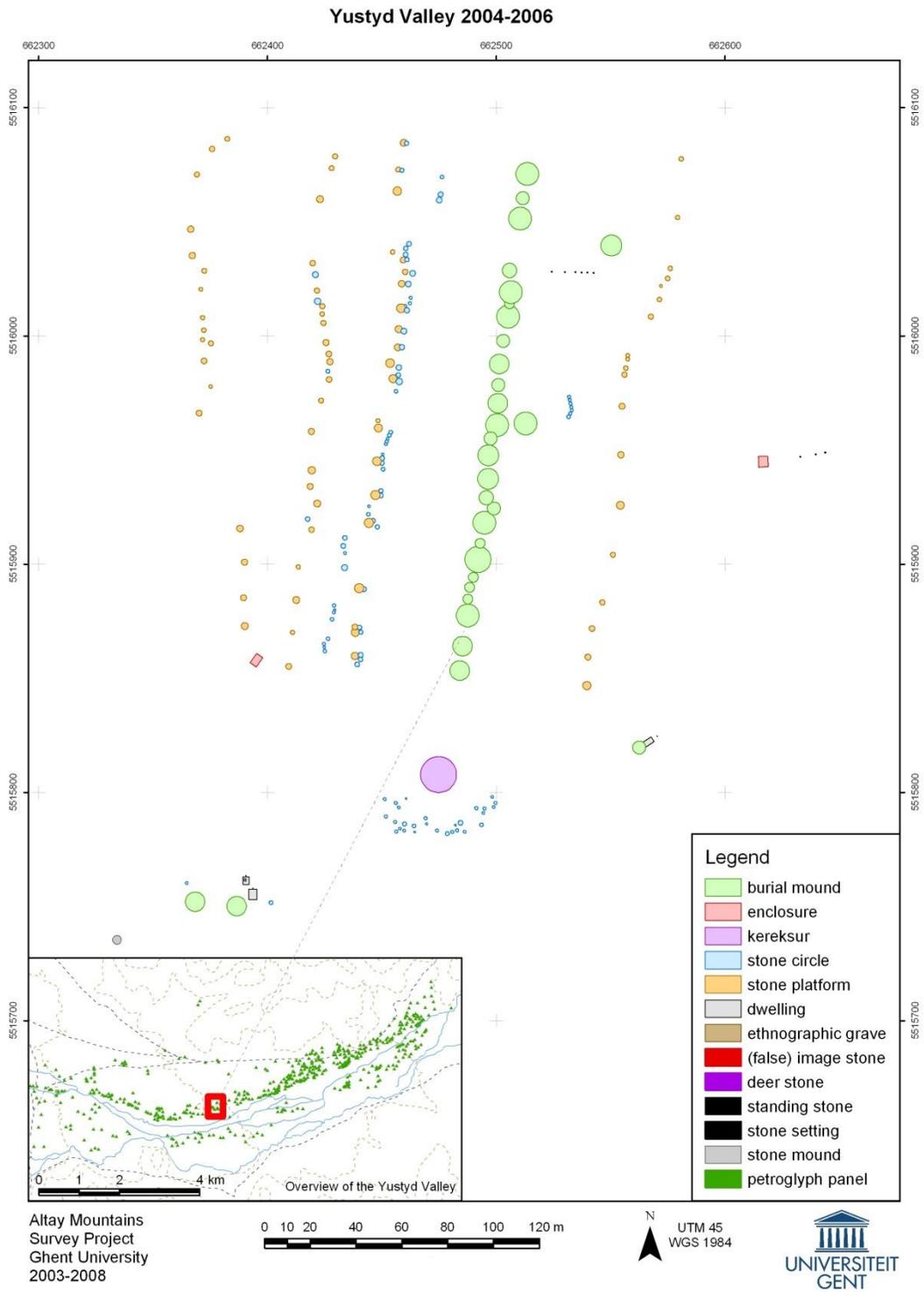
This is consistent with the global trends. On the chart, we can see that the amount of ice and snow is declining and the glacier mass balance is going down. All of this has to do with the rise in global temperatures.

The reduction in ice mass is a very sensitive measure of global climate change. If thawing begins it cannot be stopped. I hope we will discuss how we can preserve these sites and what we might be able to do to protect them. Archaeologists cannot possibly stop global change so the important question is how should we react to it?.... How can we cope?

The team I'm a member of has worked on a project with UNESCO which was funded by the Flemish government. But only the first phase was realized in 2005 and 2006 (for more information, see Bourgeois & Gheyle 2006, Han *et al.* 2008). The first two goals of this project was to map, survey and inventory the frozen tombs. We can only start protection measures, preservation, if we know the location, the context of the archaeology, and the condition of the sites. After the survey and mapping we wanted to begin monitoring the ice and the individual burial mounds. This would feed into the development of technical solutions to preserve some of these tombs in situ. The survey and database would allow us to make a selection of those in greatest peril and at greatest risk. Unfortunately funding stopped in 2006 and none of these later goals have been realized.



Wouter FIG 7. UNESCO "Preservation of the frozen tombs of the Altai Mountains" project, phasing proposal.



Wouter FIG 8. Yustyd Valley: an archaeological survey by Ghent University recorded over 5000 monuments, both large burial mounds and small structures, to study the archaeological landscape and the context of the frozen tombs. Here a detail of a typical Scythian burial ground with mounds aligned along a NS axis.

A big part of what we are doing now is about raising awareness and so we are doing a series of exhibitions in Russia and in Europe. The exhibition is still travelling and can now be seen in Norway, in the Midgard Historical Center in Horten. It is basically a poster exhibition that explains the problems of climate change and the frozen tombs in Altai, and gives information on the UNESCO project, its preliminary results and the recommendations for future work. It also included some replicas of Scythian objects found in Altai, and in Norway the colleagues added a very interesting educational part about archaeology, preservation and excavation.



Wouter FIG 9. The Frozen Tombs of the Altay Mountains exhibition, presented in Ghent (BE), Gorno-Altaysk (RU), UNESCO headquarters (FR) and Midgard Historical Centre (NR)

May Cassar: Before Andrew and Wouter engage in conversation, I would like to invite a reaction from the audience on what you have just heard. I think it would be useful, given that some conservators and conservation scientists may not be aware of the enormity of the problem or how this problem might be managed. Are there reactions to what you have heard?

Velson Hori: "It was ever thus". As has been clear from the first presentation, the rise and change in sea level has been happening for thousands of years. The sea level has gone down and revealed things and it has also gone up. Although global warming is a new event or at least an event new to us, it has happened in the past. So a lot of archaeology has been lost in the past. What is different about this, about now?

Jerry Podany, IIC: Well, we care. The conservation profession is charged with the protection of heritage, archaeological or not. So the difference is that we care.

Andrew Curry: There is something very different about the speed and the cause of what is being lost now. The change in climate is much, much faster. I think geologists have described the era we are living in as the “Anthropocene”. Which is a stab at defining, for the first time, the fact that people are changing the world. In the past these changes were “natural” (that is to say, within the context of this definition, changes that are caused by factors other than human influences). These “natural” changes happened over perhaps 16,000 years. But now we are talking about changes that have occurred over the last 50 years. And because it is faster I think it is more destructive. You can go to places and find submerged archaeology that wasn't submerged just a short time ago. We know there is a great deal of archaeological heritage that we can find now and preserve if we decide to do it...to excavate.

Wouter Gheyle: Yes, the speed of this change is significant. The loss is much faster and of course we now realize the extent of what exists and what might be lost, so we are more aware of the potential destruction.

Luciana Carvalho, conservation student UCL: I think both of your presentations highlight the fact that what we do as heritage conservators is manage change. A lot of conservators still want to stop all loss, but we can't. It should be noted that the climate of the earth always is changing, it is natural. And we as humans evolve and learn how to cope, or not, with such changes. And I think the efforts in conservation have to do the same.

Sharon Cather, Courtauld Institute: These issues are familiar to all of us in the heritage conservation world, as they are to those in the archaeological world. We have enormous problems. Enormous in scale, in numbers, and in distribution. Next to that, we have, in ministries, new infrastructures which are based on political boundaries. And so the approach that we take to managing the heritage at risk depends heavily on those administrative structures. We all work in various countries and in various parts of the world and the likelihood of success in recording, protecting and intervening for the benefit of heritage depends on that administrative infrastructure. It's inevitable. And so I suppose what we should aim for is to intervene there, at that level... try to influence the administrative infrastructures in the way for example that in China the Getty Conservation Institute and the Heritage Commission have helped China with policy. This policy has now been legally implemented.

May I ask one question? That was an interesting chart which you gave, Wouter. It provided the sequence and length, etc of different aspects of the topic. But I noticed that the longest line was excavation. I just wonder why you didn't give the number. Why have you decided on so much excavation?

Wouter Gheyle: It is not the number of sites that were shown by this long line. But the time that it takes to properly excavate, to excavate scientifically, draws the line out. Perhaps later we could discuss how we select sites that should be preserved in-situ and those that should be fully excavated. After all, archaeologists excavate for information but in the process destroy the original site.

Andrew Curry: I'm a journalist and I talk to a lot of archaeologists and visit a lot of excavations. And my urge is always to say "Dig it all up and put it in the museum." Why leave it in the ground? We want to see it. And archaeologists don't buy into that. They want to leave it underground and maybe you can explain to me, Wouter, why they feel this way.

May Cassar: But surely it's not as black-and-white as that. You will get a variation. Rather than focusing on excavation, what should the approach be? Should we be trying to develop techniques that keep the stuff in the ground and then monitor the cultural heritage that is buried? Or should we say that there is too much being lost and we should plan for excavation or risk losing cultural heritage?

Andrew Curry: I wonder if it's not the latter. We can discuss that but in the US there is a huge industry of rescue excavation. If there is a road coming through, someone is paid to come in and do excavations. Though often they are insufficient in the rush to be completed before the bulldozer arrives. Is rising temperature and rising sea level the bulldozer of the 21st century?

May Cassar: Wouter, what do we lose by doing that...by excavating too quickly? Can you elaborate?

Wouter Gheyle: Well, choosing is always losing. So what we have is the need to record and the need for continuation of scientific research. But in the end, with this approach of fast excavation, the heritage is only recorded. It is just taking an inventory of what you find. There is no money or time to do research and to be thorough. And that's the same with the issues of global warming. Because of rising temperatures we may have only 50 years before these remains disappear, so our Russian colleagues are saying "let's go in and excavate". I am opposed to that. I think we should excavate a selection and do this in a scientific way. We should pick first the monuments that are most in danger, because they will not all be destroyed at once. We should always leave something for generations to come. There can be changes in the available solutions to the problem, changes to our scientific techniques, none of which we yet realize or can imagine.

Andrew Curry: I was playing devil's advocate earlier. One of the things that I have learned in writing about this issue is that techniques that were not even in the archaeologist's imagination, say 20 years ago, are now fairly routine. For example, the study of ancient DNA. The things you had to do to gather that data did not exist at all. We didn't even know that ancient DNA could be gathered. Twenty years from now things will be even more amazing. Most archaeologists, just to dampen my enthusiasm, say we should leave as much of this on the ground as possible because future archaeologists will be much better at analysis and interpretation than we are now. I guess the threat of climate change is a bit unprecedented. So I think there are cases where you have to choose now. Some things will be lost but it's better to have some data than no data.

May Cassar: Can I just intervene? In one of your papers, Wouter, you say very clearly "to survey to record, to detect, to preserve and to monitor" are priorities. But then you say that ultimately we may have to excavate. You say that we will have to choose what we will excavate. And you emphatically said that it has to be done on a scientific basis. But is that the only way? Who else should be involved in this decision? Is it only the science that should drive this decision? The decision is about what we choose and what we excavate and what we leave behind and what we disrupt for the sake of science. And you

mentioned your interactions with local populations. How do they figure in the choices we are going to have to make?

Wouter Gheyle: Yes, these indigenous people must have an input, of course. Because they live in the landscape and the traditional culture is so very much alive. But it depends upon the type and purpose of the monument. Take for example these burial mounds. We have about 60 different kinds of structures that are visible above the ground. And these burial mounds are just one type. They are easily recognizable, people know about them. And they know that some of them are frozen. They care about their heritage so they want something to happen with it, for the better, but they don't want to excavate. They think it's disturbing the dead. So they would like us to find other solutions than excavation. But I think in the end we will have to make choices and we will have to do some necessary excavation.

May Cassar: (to audience) Can I get a reaction to this please? Obviously "who ultimately decides" is quite an important issue for conservation. If there is some reluctance by a local community to excavation should we, as conservators or scientists, still say that for the sake of science we ought to have a record of something that is going to be lost forever? If so, then what kind of dialogue do we need to enter into with the local community in order to persuade or negotiate? I wonder if any of you have the experience of this sort of thing, of engaging with communities to make decisions that are actually about the future of cultural heritage, perhaps their cultural heritage.

Liz Pye, UCL: I'm an archaeologist as well as a conservator, so perhaps I can mention Seahenge here in Britain. It is a site in East Anglia on the north coast of Norfolk. This is probably the remains of the burial mound or barrow with a wooden structure. It has been known to appear and disappear when the sand is either blown over it or blown away from it. And when it appeared fairly recently it caused a huge controversy between archaeologists and the local people. Other people, including Druids and what might be described as fringe groups, joined in the discussion. In the end it was considered to be threatened and it was removed. We learned a huge amount about the technology of the structure and of course of the time period. But what is very sad, I think, is that there is another, even better example, very close by and no one dares to touch it, investigate it, or do anything with it, and it's disappearing. I don't know what the answer is but it is a very difficult situation and my personal view is that the archaeologists did not handle it well. They did not negotiate. They did not explain what they were doing or why. And I think that could have been done better, so that today we might still be able to look at the outcome without feeling that it was a hornet's nest which we did not want to disturb.

Jerry Podany, IIC: I want to take Liz Pye's comment and connect it with an earlier comment which referred to managing change. It may be that there is no solution to the problem that Wouter is facing, the "thawing" of heritage, and the fast deterioration of organic materials as a result of that thawing. But these discussions with indigenous, local people, take a very long time to begin and to complete, indeed if they can ever be considered complete. Both conservators and archaeologists have less than a stellar track record of raising awareness and explaining their role and goals, let alone offering solutions that involve compromise. So in a way this entire discussion is really about managing change. Of finding ways to slow deterioration down while we search for resolution, if resolution is to be found. Or until we are left with only the "zero or one" decision. Does anyone know of conservation research aimed at

continuing the life of frozen sites endangered by a cyclic threat such as global warming? Is there enough research being done? Are there sufficient discussions and ideas being exchanged? Is there support? Our immediate aim may not be the long-term preservation of these resources, but rather the achievement may simply be extending the amount of time that we have available to deal with the problem. Keeping them frozen for another season or two or three, before we make the final decision to excavate and remove.

May Cassar: I think what we heard from Wouter is that the money ran out. The mapping began but the money ran out. What hasn't run out however, and what doesn't need money to that extent, is building the relationship with the local community. And while money is being raised discussions can take place on what to do, whether that be preservation or excavation. What I would be interested to know from both of our panellists is how you feel about engaging, on equal terms, with local people on how to preserve what is seen as world heritage but basically is their heritage?

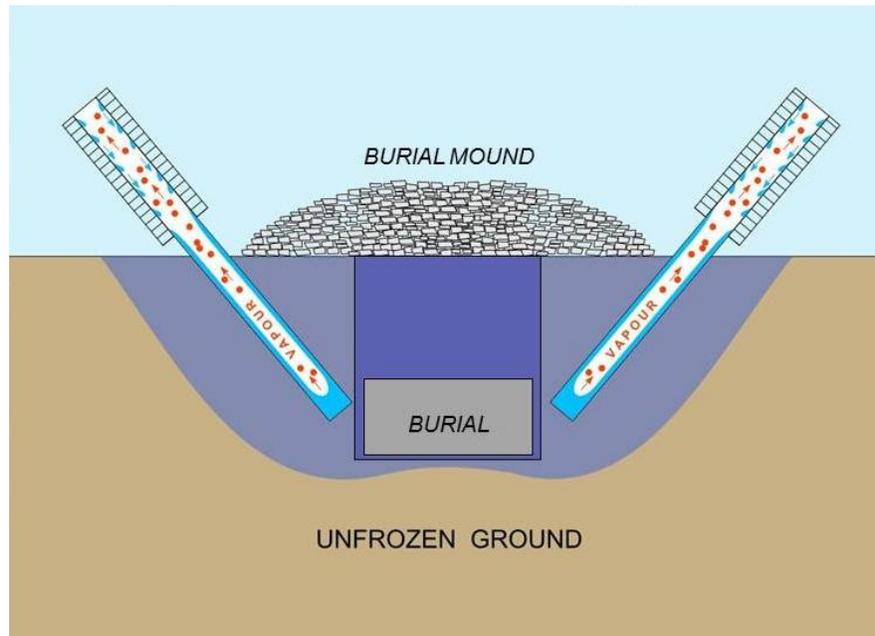
Wouter Gheyle: Well, you (Jerry Podany) have said that it is a slow process. But in my experience if one tries to engage the local population things can change and progress quickly. Archaeologists have the responsibility of explaining to the public what they are doing and what they are finding. We did an excavation last year, not on a frozen tomb but on another, more ritual structure that was completely unknown to archaeologists. Russian archaeologists did not touch it because it did not contain a grave and was considered unimportant. We had a meeting with the local population in Kosh-Agatch, one of the most remote large settlements in the Altai Mountains and the last town before you reach the Mongolian border. We were there, in wintertime, and we talked with the local leaders or *zaisan*, the shaman, and with the local government. After a year and a half we could excavate. They explained to us what they thought the monument was and what its importance was. They thought the structure was Mongolian (note: medieval period, from the 12th century onwards), but after excavations it appeared to be early Bronze Age (2000 BC). But that variance in date is not important: the point is that if the people feel they are part of the process, it can progress and change quickly.

Secondly, we do have some technical solutions to preserve the frozen context in situ. But it remains experimental. Still the techniques have been used on a large scale so maybe it can be done.

Sharon Cather, Courtauld Institute: What are these techniques? Can you explain them?

Wouter Gheyle: One of these techniques is to shelter the frozen ground. Shelter the permafrost and tomb from the sun and the rain fall while still keeping air circulation sufficient so that cold air can penetrate. This method decreases the ground temperature with 3 to 7 °C. Of course if you have a shelter like these all over a burial mound and in the landscape, it would be strange, disruptive, and the population would be against it. Another technique, which is called a thermal siphon, is a kind of physical-chemical reaction where cold air goes in and hot air goes out. This way the frozen core is preserved. This technique has been used on a large scale to protect pipeline systems, and to stabilize roads and railway systems in permafrost areas. We believe there is potential for its use to stabilize permafrost under a burial mound. There are other solutions as well but many are too expensive and some may have a

permanent impact on the monument itself. All of these should be studied and that is one of the next phases in our project. But we are waiting to get funding.



Wouter FIG 10 Thermosyphons or self-regulating seasonally acting cooling devices extract heat from the ground and dissipate it into the air, thereby lowering the ground temperature so frozen ground stays frozen (Figure: in cooperation with Sergei Marchenko, University of Alaska Fairbanks).

Mikkel Scharff, School of Conservation in Copenhagen: I would just like to ask who exactly is making decisions regarding whether to use one or another technical approach for a solution? Who makes the decision as to which grave is preserved and which is not? The dilemma reminds me of something that slowly came into use in the 1980s called a "decision-making model". This has been used in ethnographic collections to decide what to do with or how to treat objects in ethnographic collections and also to make decisions about how things were to be displayed. It has also been used to decide how to deal with contemporary art objects. It is a very useful technique when there are many different opinions and approaches regarding how an object might be treated or displayed. The technique takes into account many, if not all, the stakeholders. I am wondering if something like that is being considered in archaeology and in preservation of heritage in these endangered sites. We have after all been talking about the local population and their view in comparison to the archaeologists.

Andrew Curry: From my perspective, I think archaeology has changed a lot and has become a lot more inclusive. More attention is paid to the local perspective and, speaking for archaeological activity in the United States, things have completely changed, often by law but also from the standpoint of ethics. Archaeologists now have to ask indigenous populations or local groups for their permission or cooperation. Archaeology has become a more complicated discipline and more techniques have become available. Now when I visit an excavation there is a geologist, a chemist, a person who specializes in GIS aerial mapping, etc. As archaeologists have branched out beyond the trowel and brush, a lot of other disciplines and stakeholders have come in. And they all have input in addition to the local groups. I think all of this is a good thing.

Wouter Gheyle: I don't think many projects use the decision-making model you are describing. But it is a good suggestion, especially for the situation in Altai. Russian archaeology is very different from European archaeology. It has another tradition and a different mentality. A lot has to be done and a lot of improvements need to be made.

Andrew Curry: I am based in Berlin and I do a lot of work with the German archaeological community. There is a very different mentality in Germany from the United States and the UK. The Americans and the British love excavating and theorizing. The Germans love collecting data. They collect a lot of data before they make any kind of interpretive leaps.

Wouter Gheyle: Again, rescue archaeology or scientific research. I think I am on the side of science and scientific research. If I were given ideal funding I would gather together the ideal team and do a perfect excavation. But perhaps you are right that in the next 10 years I would only be able to save five of the tombs. And there are thousands of these burials in the Altai. Not all of them are frozen of course, but still hundreds of them are. And perhaps only five saved in 10 years is too little. However, if you give the same amount of money to teams that may be doing much more excavations, the question is if the amount of useful data gathered would be higher. I sincerely doubt it.

Andrew Curry: But it is amazing how much data you can gather with fully systematic approach to excavation. I was in an excavation in Egypt a year ago and there was a person whose whole job was to excavate tiny little fragments of the fireplace and go through the finds in order to determine what burned material was present. That was his month. That would not happen in a rescue excavation.

Catherine Rickman, conservator: This is really a terribly simple question about the frozen tombs in the Altai Mountains. Were they constructed in the summer and then allowed to freeze in the winter? Do we know whether they were constructed to prevent looting or was their purpose to give everlasting life to the inhabitants?

Wouter Gheyle: They were certainly constructed with the idea of an afterlife, but it had nothing to do with creating frozen conditions because we find these kinds of tombs all over the steps, from the Black Sea to the Altai Mountains and on to Mongolia and China. Only in the Altai Mountains do we have these frozen conditions. So in a way it's accidental. They were probably buried in the spring or summer time because any other time it would be, impossible to dig a pit of 5 m deep in the frozen ground. And additionally, when we analyze the stomach contents of the horses, we can determine what they last ate, what was available to them and thus deduce the time of year of their last meal before they were buried.

May Cassar: But you still have a great deal more to find out about these tombs and their contents.

Wouter Gheyle: Yes, of course, very much so. However, if there was no threat from climate change I would not touch the frozen tombs. I would excavate other tombs or other monuments that we know nothing about. We know a lot about these Scythian burials because there have been many excavations. But right now the excavations are really driven by an emergency situation.

Sharon Cather, Courtauld Institute: I just wanted to point out a couple of elephants marching around the room. One is what is required for an archaeologist to get a PhD and the promotion. The US for example, is still mired in the "must have a dig" mentality. I don't know how it is in Belgium but I think Germany is beyond that. I think that makes a big difference and I'm really shocked many times by US archaeologists. The other elephant is the issue of getting money to dig. It's expensive. So one must take into consideration the motivation of the people who provide the money. So there are a lot of variables in the equation and to what happens to the archaeological site. If I can indulge myself to say I agree totally with Andrew Curry that the excruciating acceleration of inexorable climate change is not something that we are going to be able to do anything about. So our strategy has to be a rearguard action. In my view we must record data before it is lost.

May Cassar: I think we can all agree with what has been said about recording data and about making sure that we survey and map. We have seen examples from both speakers. We also need to work at how to preserve and how much we can preserve, whether it is in situ or by excavation. We need to examine what the motivations behind either approach are. I think these are going to be really critical issues to consider. I think above all of monitoring and who pays for monitoring and how long can we sustain monitoring; these are going to be crucial issues that will not only challenge archaeology due to climate change conditions, but also challenge all of us, who work with museums or with archives and libraries. We will find that understanding the impact of the environment on cultural heritage, is hard work and its long-term, often boring. Accumulation of data involves analyzing the data and reacting to it and finding solutions that are appropriate. Certainly there is no universal solution.

I would like to thank both of our panellists and I will now pass the floor to Jerry Podany, President of IIC, to close proceedings.

Jerry Podany, IIC: I will close by thanking the panellists and the audience for a very enlightening dialogue and by supporting May's closing remarks. And by noting that if you go to any library or any bookshop, almost anywhere in the world, and you look for books on climate change you will find numerous books on the topic. But how many address the issue of heritage preservation and climate change? Very few indeed. The publications and work of our three panellists are exceptions and highly valued ones at that...but they are only a few in what should be a larger body of knowledge and reference.

Does our toolkit as conservation professionals only contain B72? I don't think so. An essential part of that toolkit today, in a world where our climate is rapidly changing, includes the effort to raise awareness of how that change in climate threatens the preservation of our shared heritage. The effort to raise awareness is as much a contribution to heritage preservation is anything else we do. This evening's three panellists have convincingly illustrated this point, as have you the audience. The challenges are many and the pace of change is increasing. And so we must change our focus, our priorities. We must, as one audience member put it, adapt. This does not mean abandoning preservation, but rather expanding it.

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