PAST VULNERABILITY

Volcanic eruptions and human vulnerability in traditional societies past and present

Dear colleague!

A very warm welcome to chilly Århus. I am delighted and excited that you can come to this international but intimate conference hosted by *LaPaDiS – the Laboratory for Past Disaster Science*. *LaPaDiS* is a novel endeavour funded by the Danish Agency for Science, Technology and Innovation. Its mission is to bring together scholars interested in disaster science, albeit with the particular twist that we focus on past disasters and what they can tell us about the course of prehistory and history as well as human vulnerability/resilience.

The remit of this conference reflects the mission of *LaPaDiS*. The participants come from many different countries and a wide range of disciplines ranging from volcanology, to ancient history, to linguistics, to archaeology, to theology. The main aim of the conference, as I see it, is that we will use the presented case studies as a platform to discuss how past human (post-eruption) impacts can be used to analyse the determinants of (pre-eruption) vulnerability. In this connection volcanic eruptions offer the dual methodological advantage of acting as 'revealers' or even 'triggers' of social change (cf. Garcia-Acosta 2002), and of providing with their often wide-spread fallout a chronostragiphic marker that can be used to control the temporal dimension.

Below you will find the programme for the conference, including titles and abstracts for all papers. I hope very much that we will have some productive days of presentations and discussions, and that you all will seriously consider contributing to the resulting publication. Well met!

AARHUS
UNIVERSITY
DEPARTMENT OF CULTURE AND SOCIETY

Styrelsen for Forskning
og Innovation
Ministeriet for Forskning, Innovation
og Videregående Uddannelser

Overview programme – DAY 1 – Richard Mortensen Room

0830-0900	REGISTRATION	
0900-0915	*Welcome note*	Felix Riede
0915-0945	*Attributes of vulnerability: creating a database for assessing hazard and risk*	Sian Crosweller
0945-1015	*Between the* Queen of the South Sea *and the* Spirit of Mount Merapi*: Political and cosmological dimensions of the Central Java earthquake in 2006*	Retna Siwi Padmawati & Jens Seeberg
1015-1045	*Lost in translation: Can hazard information be transmitted across cultures?*	Kathrine Cashman & Caroline Williams
1045-1100	COFFEE	
1100-1130	*Volcanism in Iceland: Perception, vulnerability and response as revealed by historical accounts*	Thor Thordarson
1130-1200	*Iceland and the permanent volcanoes: Perceptions of vulnerability in a society with no 'before'*	Lisbeth H. Torfing
1200-1300	LUNCH	
1300-1330	*Conceptions of volcanoes and geological phenomena in Medieval Icelandic literature*	Mathias Nordvig
1330-1400	*Mount Etna, Sicily: Vulnerability and resilience during the pre-industrial era*	David Chester et al.
1400-1430	*Climatic and environmental Impacts of the AD 1275 stratospheric eruption of unknown origin*	Franck Lavigne & Sébastien Guillet
1430-1500	COFFEE	
1500-1530	*Islam on volcanic eruptions and other seismic disasters*	Thomas Hoffmann
1530-1600	*Excavating the Fimbulwinter? Archaeology, Geomythology and the Climate Event(s) of AD 536*	Neil Price
1600-1700	DISCUSSION	

Coffee/tea, fruit and lunch will be provided next door to the conference room.

The conference dinner will take place at *Nordens Folkekøkken*, Jægergårdsgade 6, 8000 Århus C (see map at the end of this programme) at 1900.

Overview programme – DAY 2 – Richard Mortensen Room

0845-0900	COFFEE	
0900-0930	*The fragile landscape of Vesuvius: Against the idealized views of Pompeii*	Girolamo Ferdinando De Simone
0930-1000	*Disaster in the ancient world from the perspectives of cultural anthropology and cultural philosophy*	Jan Dietrich
1000-1030	The Boneless One and his Home*. The Sea and its inhabitants in religious beliefs on Crete and Thera around 1613 BC*	Annette Højen Sørensen
1030-1100	COFFEE	
1100-1130	*Modeling past Human Vulnerability: Comparing the effects of the Katmai 1912 and Aniakchak 3650 BP eruptions*	Richard VanderHoek
1130-1200	*Dating the* Frog Princess	Kevan Edinborough
1200-1230	The Days of the Dry Snow*: Short and long term cultural adaptations to the Mazama ash fall on the Northern Plains*	Gerald Oetelaar
1230-1330	LUNCH	
1330-1400	*Tephrochronological studies on laminated lake sediments as a tool for identifying potential triggers of extreme weather events*	Walter Dörfler
1400-1430	*'Dominant' and 'radical' perspectives on material culture change in the wake of the catastrophic Laacher See volcanic eruption (12,920 cal BP) in Northern Europe*	Felix Riede
1430-1500	COFFEE	
1500-1530	*Human vulnerability in a Middle Palaeolithic context: response of hunter-gatherers in India to the ~74 ka Toba supervolcanic eruption*	Sacha Jones
1530-1600	*Consequences of the Toba super-eruption for human adaptation and evolution*	Stanley Ambrose
1600-1700	DISCUSSION	

OBS. Walter Friedrich, Emeritus Professor in Geology at Aarhus University will give a public lecture (in Danish) at 1700 on the Main Campus – please let me know if you would like to attend.

Depending on interest we will organise a joint dinner that evening *ad hoc*.

DAY 1

Abstracts

Sian Crosweller, University of Bristol (UK)

Attributes of vulnerability: creating a database for assessing hazard and risk

As part of VOGRIPA (Volcanic Global Risk Identification and Analysis Project, see www.bgs.ac.uk/vogripa) we are constructing databases of volcanic hazards alongside data on vulnerability in order to be able to make an assessment of volcanic risks on global, regional and local scales. This is not a trivial task as there is no absolute definition of what attributes are relevant to assessing vulnerability, and exactly how this interacts with the physical system (the hazard) to produce risk. Moreover, in order to include vulnerability within a database, attributes need to be clearly defined, able to be quantified, be that through absolute numbers (e.g. numbers of fatalities) or scales/indices (e.g. level of volcanic monitoring). However, despite the difficulties, this is a necessary task. Through collating this data, it will be possible to identify areas at greater threat from future volcanic disasters based on past activity, as well as allowing for current factors linked to vulnerability to be taken into account. In doing so, it is hoped that steps can be taken to reducing vulnerability to volcanic hazards, particularly in those areas identified as being at high risk, and thus reduce the chances of future volcanic-related disasters. This aspect of VOGRIPA is in its very early stages. The first task is to identify and evaluate existent vulnerability databases. These may not be related to volcanic hazards, as many aspects of vulnerability will cross-over between hazards, but not all will be relevant. The availability of data will also need to be considered when determining what attributes to include. The final crucial stage will be to carefully consider how this information is linked with the physical hazard data in order to make an analysis of the risk.

Retna Siwi Padmawati (Universitas Gadjah Mada, Indonesia) & Jens Seeberg (Aarhus University, Denmark)

Between the Queen of the South Sea and the Spirit of Mount Merapi: Political and cosmological dimensions of the Central Java earthquake in 2006

Understood as a totalizing event of potentially massive social disruption, disaster poses important theoretical and methodological challenges for anthropology. At the same time, anthropology may contribute important insights to the knowledge of disaster. This paper analyzes events related to the earthquake in Central Java on 27 May 2006 as well as eruptions of the volcano Mount Merapi in 2006 and 2010. Based on ethnographic fieldwork, we explore cosmologically embedded explanations of the events, where the earthquake may be understood locally as questioning the legitimacy for the current Sultan of Yogyakarta. In contrast to the notions of Javanese harmony and consensus that are key elements of Indonesian cultural politics, we find intense negotiations and contesting claims at local levels. These processes are contextualized in terms of pre- and post 1998 administrative arrangements. The analysis points to complex relations between the interpretation of natural disaster and the nascent democracy in Indonesia and specifically in Central Java.

Katharine Cashman & Caroline Williams, University of Bristol (UK)

Lost in translation: Can hazard information be transmitted across cultures?

A major problem in modern societies is mobility, in that many (particularly urban) dwellers live and work away from the place where they were raised, and thus commonly lack traditional knowledge about their local environment. This lack of knowledge is particularly damaging in locations prone to infrequent natural hazards (volcanic eruptions, earthquakes and floods). Traditional societies often transferred knowledge about natural hazards via stories, sacred areas, and landscape names, thereby embedding the knowledge into the culture. The subtleties of these lessons are often lost to newcomers, however, who either ignore local knowledge or, more often, overprint the landscape names and traditional stories with imported ones. We explore knowledge transfer across cultures using the specific example of early colonial Guatemala, where the checkered history of the capital city highlights the perils of ignoring local hazard information. In 1524, Pedro de Alvarado initiated discussions about a location for the first city of Santiago de los Caballeros[1]. Records of these conversations show that the settlers were struggling to balance considerations of water, pasturage and building materials with unfamiliar natural hazards relating to the proximity of the preferred site to three volcanoes: Fuego, the "Fireplace"; Acatenango, the volcano of snow, and Agua, "pekul ya" or "Cave by the Water"[2]. In the end, familiar considerations won out and the new capital city was founded at the foot of the volcano Agua; in 1541 the city was destroyed by a large flood of water (perhaps triggered by an earthquake) emitted from the volcano, and the capital was moved northwest, to the new city of Antigua. Here the capital remained until 1717, when the combined effects of volcanic eruption and an earthquake destroyed much of Antigua. A new round of discussions about the city's location ensued, this time focused around a debate of whether to relocate once again, or to learn to live with the hazard. The latter course of (in)action was decided, and Antigua remained the capital city until it was destroyed by an earthquake in 1773, and the capital was finally relocated to Guatemala City. This history illustrates not only the extent to which local knowledge (such as that encoded into place names) is commonly ignored by newcomers to a region, but also the difficulties of imagining events outside of one's own experience when confronted with a new environment.

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[1] From Alain Musset, 'Mudarse o Desaparecer. Traslado de ciudades hispanoamericanas y desastres (Siglos XVI-XVIII), in Virginia García Acosta (ed.), Historia y Desastres en América Latina, Vol. 1 (La Red/Ciesas, 1996).

[2] Dennis Tedlock "Popul Vuh" Touchstone, New York, 1996

Thor Thordarson, University of Edinburgh (UK)/University of Iceland (Iceland)

Volcanism in Iceland: Perception, vulnerability and response as revealed by historical accounts

Iceland is one of the most active volcanic regions on Earth; where a volcanic event takes place every 4 or 5 years on average. The effects of volcanism are profound in Iceland, because since settlement 1140 years ago, every generation of Icelanders has been exposed to volcanic eruptions and their consequences. For that very reason, volcanism has been a force in shaping Icelandic society and history, to such an extent that it is imprinted into the cultural landscape. The comparatively well-documented volcanic history of Iceland, both in historical and geological terms, provides a platform for assessing societal perception, vulnerability and response to volcanic eruptions and changes therein with time. Preliminary analysis of the historical records suggests that due to the unyielding exposure from volcanic eruptions, the early settlers quickly adapted pragmatic views towards such events and their consequences. Eruptions were seen as act of nature and generally not linked to the supernatural. This view has prevailed and most likely for practical reasons. Accrediting volcanic eruptions and their effects to chastisement by God or other supernatural phenomena would have undermined the integrity of the authority because within any one region all individuals, irrespective of their social status, were equally vulnerable. Hence, such rationalization would challenge the established social structure. Furthermore, it is possible that the matter-of-fact view towards volcanic eruptions that appears to have filtered through in society upheld a better public understanding of these events and promoted practical solutions (i.e. mitigation) in dealing with their consequences. For example, the more enhanced descriptions of volcanic eruptions that emerged after acceptance of Danish rule and Lutheranism are more likely to have surfaced from need to ease affairs in dealing with Danish authorities in time of crisis. Other examples and aspects of perception, vulnerability and mitigation to volcanic eruptions, as revealed by the historical archives in Iceland, will be presented and discussed.

Lisbeth Heidemann Torfing, Aarhus University (Denmark)

Iceland and the permanent volcanoes: Perceptions of vulnerability in a society with no 'before'

What happens in a society, which has no 'before' or 'after' the catastrophe, where volcanic activity is a constant, yet unforeseeable presence? I will analyze some consequences in medieval Icelandic society. One such is that their own perception of vulnerability changes in two opposite directions, as I will demonstrate: On the one hand, they are aware of the constant danger of volcanic eruptions. On the other, perceptions become less catastrophic and more realistic in nature, valuing concrete loss resulting from volcanic activity on a par with other destructive events. One important contribution, which the Icelandic sources in particular can make, is to provide some examples of the types of interpretive frames that people use to understand volcanic events. Two types of distinctions seem essential, namely those of religious versus cultural ideas and those of abstract versus concrete danger and vulnerability. In which of these regimens do we find volcanic eruptions and general activity? In other words, what does the cultural artefact (as opposed to natural phenomenon) 'volcano' signify? The answer to this is complicated. The first important thing to note is that the abstract construct 'volcano' as the member of a category 'volcanoes', which may then exhibit 'volcanic activity', simply does not exist in Old Norse language. This means that it is impossible to speak of volcanic activities in a general manner. Every mention has to be concrete. This points in the direction of concreteness in perceptions of danger and vulnerability in connection with volcanoes. The same is the case for the placement of accounts in the medieval annals. Here, we mainly find volcanic activities together with accounts of sunken ships and fires. Volcanic activities may also be split, so that 'sól rauð', 'red sun', is found with accounts of two moons being seen and the like. This is all opposed to the comets, which are placed first. In medieval Christian thought, comets are heralds of disasters and therefore an abstract danger. As for the religious versus cultural sphere, it seems that volcanoes do play a part in religious thought before as well as after the conversion in Iceland, albeit with quite different roles. This does not mean, however, that volcanic eruptions are necessarily interpreted in a religious frame. On the contrary, it seems that most volcanic activity is understood and evaluated on a purely cultural background which changes with the context; in *Landnámabók*, which is concerned with the right to land, lava covering previously farmable land is the dominant volcanic effect, while it is not mentioned in most other sources. In my paper, I will analyze perceptions of vulnerability concerning volcanic activity in Old Norse culture, with a special focus on the distinction between abstract and concrete danger and vulnerability. I will then evaluate the consequences for the cultural attitude towards vulnerability. This will give some inside knowledge about what vulnerability is to the people who experience it continually, and how they measure it.

Mathias Nordvig, Aarhus University (Denmark)

Conceptions of volcanoes and geological phenomena in Medieval Icelandic literature

This contribution will explore how Icelanders have culturally negotiated their highly active underground from the time of settlement in c. 870 to the end of the medieval period in the 16th century. The sources to knowledge about the Icelandic attitudes and conceptions about volcanoes and geological activity are scarce. In many cases, those texts that do represent some notions on the subject are literary texts of a highly fictitious nature. In the few cases where the representation of volcanoes and geological activity is not to any noteworthy degree fictionalized, we find that the level of detail in information is often at a minimum. In the overall view of medieval Icelandic literature it is perhaps possible to identify three modes of representation of volcanoes and geological activity. These can tentatively be defined as: 1) a learned modus 2) an indigenous modus and 3) a representational modus that is relatively free of the two other discourses. In group no. 1 is found saga texts such as the Saga of the Christianization (*Kristni saga*) and the high literature of the King's Mirror (*Konungs Skuggsiá*). These texts borrow much of their attitude to geological phenomena from learned Latin sources. Group no. 2 consists of texts that are mythological or belong to the genre of fables which are, for instance, Snorri Sturluson's *Edda* from 1220, eddic poems like *Vǫluspá* and not least the prosimetric short-story of the Tale of the Bergbúi (*Bergbúa þáttr*). These texts reveal conceptions of geological phenomena that are hardly explained as directly derived from a learned discourse, and it can possibly be surmised that they are expressions of indigenous conceptualizations. The third and last group of texts consists solely of the Icelandic annals, which as a group of sources has been held in high regard by historians for a long time, but on this particular subject offers too little information to be useful. In my contribution to the LAPADIS conference I will offer some perspectives on the aspects of Icelandic conceptions of geological activity in the medieval period based mainly on the second group of texts. I will focus on the details in Old Norse mythology that refer directly to volcanic eruptions, lava and earthquakes, and those that borrow from such phenomena in the formulation of conceptions of natural processes and events. This I will do in the attempt to establish an approximation to the role that geological activity in the Icelandic underground can have had in the minds of the earliest Icelanders. This will be done with reference to the two other groups of texts, in particular group 1.

David K. Chester, University of Liverpool (UK), Angus M. Duncan, University of Bedfordshire (UK) & Heather Sangster, University of Liverpool (UK)

Mount Etna, Sicily: Vulnerability and Resilience during the Pre-Industrial Era

Mount Etna is one of the world's few continually active continental volcanoes and its frequent flank eruptions have been recorded from classical times. These studies have generated a vast literature which, not only enables the impact of eruptions, recovery from them and aspects of human vulnerability and resilience to be brought into focus, but also provides information that allows an assessment to be made of the interplay between environmental, economic and social forces which has shaped this area of Sicily into its most distinctive region. In this paper we argue that this distinctiveness developed indigenously in the long *pre-industrial era*, that stretched from late antiquity until the 1923 eruption during which eruptions were managed with relatively little outside help or intervention. The 1928 eruption marks a transition after which progressively greater State intervention occurred in each subsequent event. In the *pre-industrial era* eruptions were managed at three levels: by individuals, family and extended family groups; through mutual support within village communities, in which religious belief and explanations for losses provided both a social cement - the church often providing leadership and pastoral support - and a context in which losses could be explained; and through very limited State involvement. Finally we argue that these indigenous mechanisms of coping hold important lessons about how disasters on Etna may be managed today.

Franck Lavigne, Panthéon Sorbonne Université (France) & Sébastien Guillet, University of Bern (Switzerland)

Climatic and environmental impacts of the AD 1275 stratospheric eruption of unknown origin

Almost all ice-core records from both Polar Regions have identified a large acid spike between 1274 and 1279. Records of unusual weather and atmospheric optical and severe damage crops, as well as tree-rings growth anomalies allowed us to suggest that the eruption probably took place in 1275. A large number of written sources highlight massive rainfall anomalies and abnormal temperature prevailing across Europe during the summer months. For instance, the chroniclers of Vienna and Heiligenkreuz (Austria) complain about the lack of heat and unusual high nebulosity that prevent that year all the fruits of earth from attaining maturity. In Vienna, due to cool summer and frost damaged, the vineyard harvest lasted until the 13th November, whereas the vineyard harvest usually ended the 15th October previous years. Others historical accounts suggest the presence of a stratospheric dry fog over Europe in 1276. Two chronicles respectively written in England and Russia report the occurrence of an abnormal dark lunar eclipse: “There was a total eclipse of the moon on the night of the feast Clement; the moon was so completely eclipsed for nearly two hours that scarcely a trace of it remained visible.” “In the same winter there was a sign in the moon in the month of November. It lost its light completely without a trace, and little by little it reappeared”. Frost damage and light rings have been detected in North American tree-ring series for the years 1275 and 1276. All these evidence lead us to conclude that a tropical eruption might be at the source of the sudden cooling which seems to have affected Europe and North America.

Thomas Hoffmann, Aarhus University (Denmark)

Islam on volcanic eruptions and other seismic disasters

In this paper I primarily investigate the potential religious effects of volcanic eruptions and related seismic events (esp. earthquakes) in relation to the genesis and outlook of Islam and its holy text, the Qur'ân in the early 7th century. Though eruptions are not mentioned explicitly in the Qur'ân (in contrast to earthquakes) it contains various mytho-poetic indices that could hint at a collective volcanic memory. In this regard the analysis is beholden to Elizabeth & Paul Barber's monograph *When They Severed Earth from Sky: How the Human Mind Shapes Myth*, which advances the thesis that myths originally transmitted real information about real events and observations. These religious effects, however, probably also correlate with ecological, economic, and social effects as well and have been considered recently in an article by the Russian poly-scientist Andrey Korotayev et al. In this paper I will discuss how natural disasters and vulnerability was exploited successfully in Islam's most ancient past, in its religious discourse and in its socio-political organization.

References:

Barber, E. & P. T. Barber 2004. *When They Severed Earth from Sky: How the Human Mind Shapes Myth.* Princeton, NJ: Princeton University Press.

Korotayev, A., V. Klimenko & D. Proussakov 1999. Origins of Islam: Political-Anthropological and Environmental Context. *Acta Orientalia Academiae Scientiarum Hung.* 52(3-4), 243-76.

Neil Price, University of Aberdeen (UK)

Excavating the Fimbulwinter? Archaeology, geomythology and the climate event(s) of AD 536

There is now general agreement among geoscientists that in the year AD 536, and for varying lengths of time thereafter, several parts of the world experienced a prolonged solar darkness. This took the form of a loosely termed 'dust veil' blocking the sun's warmth from reaching the earth, traceable in numerous environmental proxies. Various causes have been put forward - including atmospheric debris from a volcanic eruption or the impacts of comets and/or meteorites – but no consensus has been reached. It has also been persuasively argued that the '536 event' may have been a combination of different events and causes, occurring within a relatively short space of time in different locations. Numerous textual sources from the period independently describe what was clearly a natural disaster of some magnitude, with a range of catastrophic effects including crop failure, famine and civil strife. This scientific debate on the origins of the 'dust veil' has absorbed the bulk of scholarly attention, with much of the study devoted to its human impact tending to drastically over-estimate its allegedly catalytic role in long-term geopolitical events. In this paper, building on work by the author and other archaeologists including especially Bo Gräslund, attention is instead focused on a case study of vulnerability in the late Iron Age cultures of Scandinavia. The excavated record is used to postulate the potentially extreme impact of the 'dust veil', and to explore what kinds of social transformations it may have caused. A possible geomythological legacy in the stories of the Fimbulwinter – the prelude to the Ragnarök and the end of the worlds – is then presented and critically reviewed.

DAY 2

Abstracts

Girolamo Ferdinando De Simone, University of Oxford (UK)

The fragile landscape of Vesuvius: against the idealized views of Pompeii

Pompeii is generally reckoned as the ideal example of a mid-rank Roman city in the first century AD. In fact, the volcanic ashes that buried the town provide a sharp *terminus ante quem*, which is used to create pinpoint history. Nevertheless, the clear snapshot provided by Vesuvius generated the assumption according to which, eruptions apart, the landscape was static and acted as a sort of canvas for human activities. This paper provides some insights into the innate fragility of Vesuvius and discusses how people reacted to the "minor catastrophes" which frequently occurred in the environs of the volcano. In particular, the paper discusses the effects of earthquakes, bradyseism, landslides, flash floods to settlements and the human response to them, like the reconstruction and reinforcement of buildings. In the last part, the paper will describe and discuss the issue of resettlement around Vesuvius after the AD 79 eruption, in particular the role of the cities in resettling the countryside and the social change that occurred.

Jan Dietrich, Aarhus University (Denmark)

Disaster in the ancient world from the perspectives of cultural anthropology and cultural philosophy

The issue of disaster forms a new perspective in anthropological research and has been investigated more deeply in recent years. This lecture will focus on the questions of how disaster is defined, how it evolves and how it is coped with from an anthropological perspective. This anthropological perspective will include insights from the cultural, sociological, and philosophical sciences, and apply them to the ancient cultures. The definition of disaster from a scientific viewpoint may vary significantly from the perspectives the ancient cultures develop when coping with disastrous phenomena. Therefore, next to a scientific viewpoint, the ancient perspectives on disaster form another main topic of this lecture: How did the ancient cultures dealt with disasters? How did they perceive and define disasters? How did disasters evolve and what strategies did the ancient cultures develop to cope with disasters? Disasters had to be included into the ancient world-views. They had to be dealt with by actions, mainly rituals. And they could be coped with by narrative. In the end, the aim of this lecture will be to produce a concept of disaster from an anthropological perspective applicable to the ancient world.

Annette Højen Sørensen, Aarhus University (Denmark)

The Boneless One and his Home. The Sea and its inhabitants in religious beliefs on Crete and Thera around 1613 BC*

During the Late Minoan IA period in Thera, the sea itself and animals from the sea were frequently present in artistic representations. The iconographic program of the West House in Akrotiri is a conspicuous example of this fact. Here, the entire scheme of the fresco-decorated rooms refers to water (both sea and fresh) in its various symbolic connotations. This is quite natural as aquifers were scarce and fresh water had to be collected from spring caves and during the rainy season. Likewise, the islanders were very dependent on the sea and had to rely on the winds and currents to cross it and bring home essential goods. The predominant animal connected to the sea in the iconography of Santorini, prior to the volcanic eruption of 1613 BC, is the dolphin. In later periods the dolphin was associated with the main sea god, Poseidon, and represented Poseidon's good will and temper – contrary to the bull. Furthermore, dolphins designate a sea where fish are abundant and thus well suited for fishing. In Crete during the Middle Minoan – Late Minoan IA periods marine shells appear in religious contexts but following the destructions at the end of Late Minoan IA – in Late Minoan IB a new type of decorative element appear in the figurative art of the Minoan Crete. Pottery vases decorated with octopuses and various shellfish become a new class of fine ware pottery known as the *Marine Style*. This pottery style was most probably produced at the palatial centre of Knossos, in the central part of the island but was especially popular in East Crete at for instance Palaikastro. Furthermore *Marine Style* pottery is quite often found in association to religious contexts. This paper will explore the sudden appearance of the *Marine Style* pottery in the wake of the Santorini Eruption in *c.* 1613 BC.

*Hesiod, Works and Days, lines 424-425

Richard VanderHoek, Alaska Office of History and Archaeology (USA)

Modeling past human vulnerability: Comparing the effects of the Katmai 1912 and Aniakchak 3650 BP eruptions

Many North America archaeologists for decades have used the cultural effects of the 1912 Katmai/Novarupta eruption, the largest volcanic eruption of the 20th century, as an analog to suggest that previous northern volcanic eruptions had little impact on human populations. Fortunately researchers in recent years have moved beyond these facile comparisons, noting that the impacts of large ecological events on human populations are determined by a variety of factors, including the scale of the event, the type of impacts, and the vulnerability and resiliency of the human population affected. This paper compares the impacts of the 1912 Katmai eruption against the probable impacts of the 3650 BP Aniakchak eruption in southwest Alaska. The main human impact from the Katmai eruption was the tephra fall on the Katmai coast and Kodiak Island, which fell on a marine adapted population reinforced by the logistic and economic support of a nation state. A much larger volcanic eruption over a hunter/gatherer population in a terrestrial Subarctic/Arctic environment would be a very different matter. Ecological data suggests that Arctic and Subarctic biota, including human hunter/gatherers, are very vulnerable to sudden ecological and climatic change. The 3650 BP Aniakchak eruption was a very large eruption with wide ranging pyroclastic flows, tsunamis and ash falls that heavily impacted Bristol Bay and western Alaska. The eruption left a large sulfuric acid signature in the Greenland ice cores, suggesting dramatic downwind acid fallout and a strong climatic impact. It is argued that the hunter/gatherer groups in southwest, western, and northwest Alaska, particularly those relying on terrestrial biota, were vulnerable to the rapid onset of the ecological and climatic effects of the Aniakchak eruption and were extirpated from the region.

Kevan Edinborough, University College London (UK)

Dating the Frog Princess

Persistent elements within First Nation oral histories offer researchers considerable insight into the prehistory of the Pacific Northwest Coast. Oral elements strongly associated with volcanic activity and migration events, for example those surrounding *Dzalarhons* (The Frog Princess) from *Haida* traditions, are particularly interesting in this respect. Using a large database of radiocarbon dates collected from a case-study region within the Pacific Northwest, I reconstruct a tentative model of population history, and present a radiocarbon test of the relationship between volcanic activity and specific migration events, which are recorded in localized First Nation oral traditions.

Gerald A. Oetelaar, University of Calgary (Canada)

The Days of the Dry Snow: Short and long term cultural adaptations to the Mazama ash fall on the Northern Plains

The climactic eruption of Mount Mazama in 7627±150 cal yr BP spread a thick layer of volcanic ash over 1,000,000 km^2 of western North America. The eruption and subsequent ash accumulation had a devastating impact on the continental vegetation and animal populations. More importantly, this unusual catastrophic event exposed a number of vulnerabilities in the social and subsistence strategies of the resident population. In particular, the long-term unpredictability in the availability of subsistence resources eventually culminated in the depletion of the stored food supplies and forced the resident human groups to seek the assistance of their relations living beyond the limits of the ash fall. As a result of this population displacement, the former occupants of the Northern Plains acquired new food preparation techniques and strategies for the long term storage of essential resources. To avoid similar disasters in the future, the interacting groups also expanded their social safety nets through the establishment of extensive trade networks thus providing access to a large aggregate of people well beyond the limits of their respective homelands. Using data recovered from deeply stratified archaeological sites occupied before and after the ash fall, I will explore the vulnerabilities of pre-eruption societies through an analysis of the social and technological changes adopted by the hunter-gatherer groups after this unusual natural disaster.

Walter Dörfler, Kiel University (Germany)

Tephrochronological studies on laminated lake sediments as a tool for identifying potential triggers of extreme weather events

Tephrochronology primarily is a tool for enhancing the dating of palaeoecological records. For this purpose a method was developed to find and identify distant tephra deposits, so called cryptotephra, in bogs and lakes. As raised bogs are mainly fed by rainwater these sites offer a good basis for studies with little background noise of dust particles. The application to lake sediments makes is necessary to apply gravity deviation to enrich samples with relatively light tephra particles. Nevertheless a 'tephra layer' consists of a small number of typical glass particles, 0.02 mm to 0.08 mm in size. These have to be found and prepared for electron-microprobe analyses. Recently three layers were identified in the laminated lake sediments of Lake Belau that could be linked to eruptions of Icelandic volcanoes: The Lairg B event (c. 6835 cal BP), the Hekla 4 event (c. 4396 cal BP), and the Hekla 3 eruption (c. 3101 cal. BP). These eruptions are taken as example for potential triggers of extreme weather events. Historical and modern analogues will be presented to evaluate the degree of local regional and over-regional impact that may initiate catastrophic developments.

References:

W. Dörfler, I. Feeser, C. van den Bogaard, S. Dreibrodt, H. Erlenkeuser, A. Kleinmann, J. Merkt, & J. Wiethold. 2012. A high-quality annually laminated sequence from Lake Belau, Northern Germany: Revised chronology and its implications for palynological and tephrochronological studies. *The Holocene* 22(12), 1413-1426.

Felix Riede, Aarhus University (Denmark)

'Dominant' and 'radical' perspectives on material culture change in the wake of the catastrophic Laacher See volcanic eruption (12,920 cal BP) in Northern Europe

In 12920 cal BP the Laacher See volcano, located in present-day western Germany, erupted catastrophically. This very large and highly explosive eruption led to the deposition of fallout tephra over large parts of Central Europe. In addition, ejecta from the eruption dammed up the nearby River Rhine. The resultant lake flooded the low-lying landscape, and dam collapse during or shortly after the eruption sent flood-waves far downstream. Interestingly, the archaeological record of this period documents a variety of responses to this event along the proximal-to-distant transect, where the affected forager groups also would have varied in their specific economic strategies and their connectedness within contemporaneous bio-social networks. Disaster scientists working in recent settings fall into two broad schools: The 'dominant' approach that forefronts the physical properties of the hazardous event, and the 'radical' approach that focuses more on the political and ecological/economic constellations of the affected communities. In this paper I will review the effects of the Laacher See eruption on flora, fauna, and human foragers from first a dominant and then a radical perspective. In particular, I will attempt to use the Laacher See event to reflect on why the affected hunter-gatherer communities in different parts of Europe were or were not vulnerable to such an environmental challenge. The main thesis of this paper is that mechanistic, i.e. dominant, explanations fall short of capturing the causes and temporalities of culture change set into motion by the Laacher See eruption. In addition, I show that the most pronounced changes brought about by this eruption happened not in areas directly affected by the eruption of its fallout, but rather in an area isolated by it.

Sacha Jones, University of Cambridge (UK)

Human vulnerability in a Middle Palaeolithic context: response of hunter-gatherers in India to the ~74 ka Toba supervolcanic eruption

In assessing the response of prehistoric populations to volcanic eruptions, there are two principal challenges that are central to the research agenda. First, pre-eruption hunter-gatherers need to be characterized in terms of their habitats, population structure, social structure and behaviour. Only with this information can we then begin to identify and quantify their vulnerability. Second, refined chronologies are essential for accurately correlating an eruption with its human consequence and for ruling out coincidence. Both of these challenges are particularly problematic in Palaeolithic research where archaeological and palaeoenvironmental records are fragmentary and chronological resolution becomes poorer with increasing time-depth. Drawing on the results of several years of multi-disciplinary research, this paper addresses these issues by examining the response of populations in India to the ~74 ka Toba supervolcanic eruption. Specific focus is placed on evidence from Jwalapuram in southern India, where archaeological and palaeoenvironmental data was collected by excavating several pre- and post-Toba contexts and used to determine Toba's local human and environmental impacts. The evidence from this site provides a good example of the nature and range of information that we currently possess for discerning past vulnerability in contexts of such great antiquity. Whilst the Toba supereruption was a catastrophic event with widespread consequences in terms of its ash-fall and climate change, a micro-scale approach to understanding its human impacts is petitioned here. This approach is used to argue that the variable ecological and social conditions facing hunter-gatherers pre-Toba would have elicited a diverse array of microevolutionary processes and heterogeneity in terms of Toba's human impacts.

Stanley H. Ambrose, University of Illinois (USA)

Consequences of the Toba Super-eruption for human adaptation and evolution

The Toba super-eruption 73.5 thousand years ago (ka) was the largest explosive volcanic events of the last 23 million years. It may have caused a six-year long volcanic winter. This event occurred soon after the onset of an 1800-year-long era of the coldest temperatures recorded in the Greenland ice cores (Greenland Stadial Event 20). Volcanic winter may have contributed to the intense cooling of Stadial 20. The subsequent early last glacial era of extreme cold (Marine Isotope Stage 4), from 70-60 ka, likely prolonged the environmental and demographic impacts of Stadial 20. Environmental, paleontological and genetic evidence shows that this period witnessed deforestation in central India, low lake levels Africa, boreal conditions in western Europe, population bottlenecks in several large mammal species, including humans and neanderthals, and regional or total extinction of a dozen southeast Asian large species. Uncertainties in correlations of geological, geochemical, genetic, paleontological and archaeological records due to inaccurate and imprecise dating methods, differences in interpretation evidence, and the failure of sophisticated climatic models to reproduce ice core records of climate change following the Toba super-eruption have sustained debates over its impacts on global climate and human evolution. I shall review these debates and suggests pathways toward resolution of some outstanding problems of interpretation. Modern humans and neanderthals apparently responded to cold early glacial environments in different ways. African archaeological evidence suggests a transition in human social and territorial organization from small, defended territories to extended inter-group cooperative, information-sharing networks. Cooperation may have helped to reduce risk in the unpredictable environments of the early last glacial. Conversely, neanderthals apparently continued to live in small, closed territories with limited intergroup interactions, often involving interpersonal violence and cannibalism. African moderns thus behaved more like human tribes; neanderthals behaved more like primate troops. These differences in social and territorial organization and information sharing may have contributed to the eventual replacement of neanderthals by African modern humans during the last ice age.

Practical matters

The conference venue is located in the northern part of the **Aarhus University Main Campus**. The meeting itself will take place in the **Richard Mortensen Room**, Frederik Nielsens Vej 2-4, 8000 Aarhus C – there will be signs of the kind you see on the next page guiding you there. That's a 30min walk from the hotel through town and across campus – a great idea if the weather is good. Alternatively, you can use most busses leaving from the bus stop on **Hans Hartwig Seedorff Stræde** or **Busgaden** around the corner from the hotel: Lines 1A, 12, 13, 18 will take you very close to the venue. The relevant bus stop is called **Århus Universitet, Randersvej/Nordre Ringgade**. Please note that the busses only take cash, so please make sure you have some coins on you. If lost or in doubt ask at the hotel reception or passing strangers.

The nearest bus stop of all lines running directly from the hotel to the University is marked on the map. In case of emergency or confusion my mobile phone number is +45 60187382.

AARHUS
UNIVERSITY
DEPARTMENT OF CULTURE AND SOCIETY

LaPaDiS
The Laboratory for Past Disaster Science

PAST VULNERABILITY

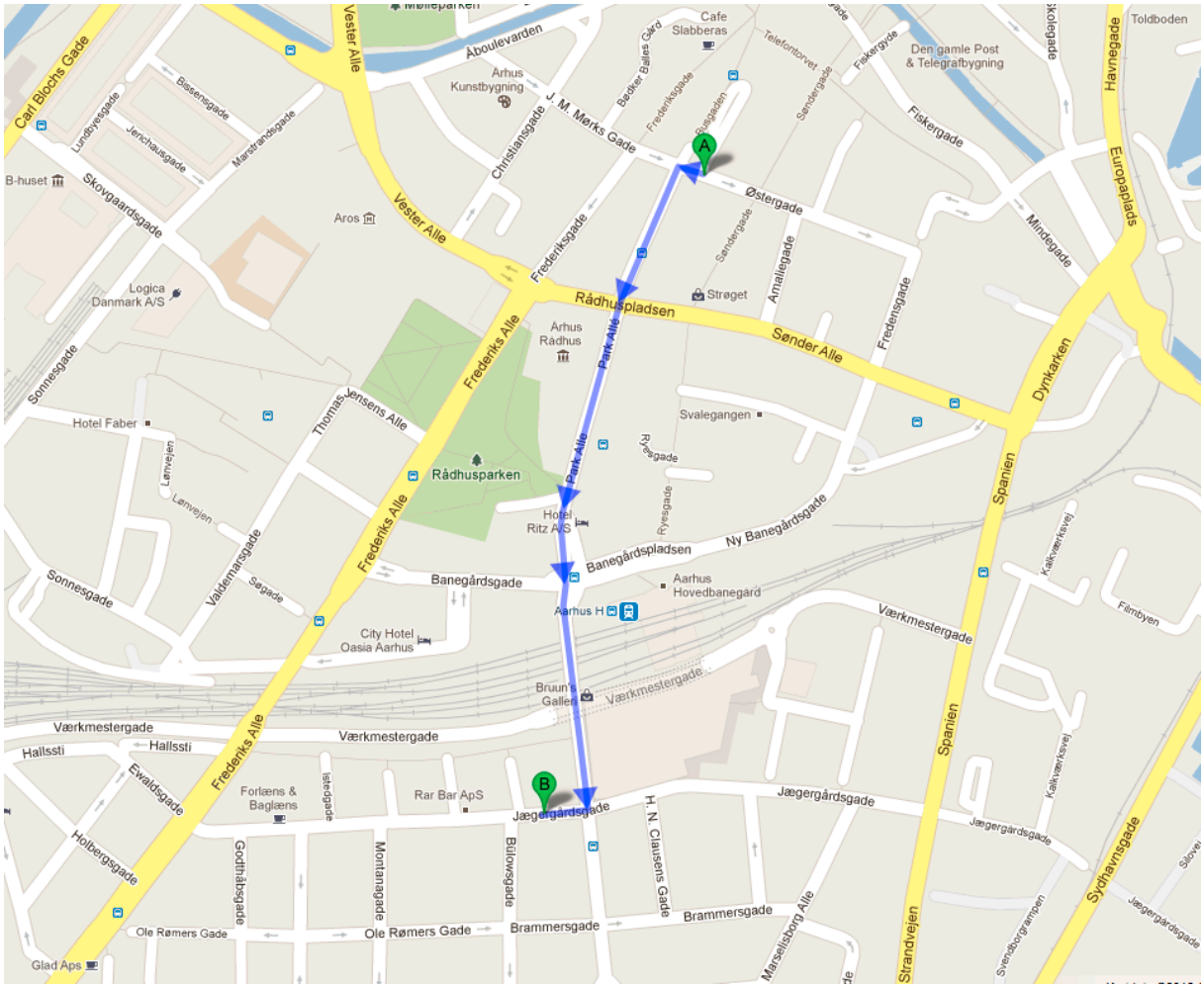
Volcanic eruptions
and human vulnerability
in traditional societies
past and present

An international conference
January 14th-15th, 2013
Richard Mortensen Stue

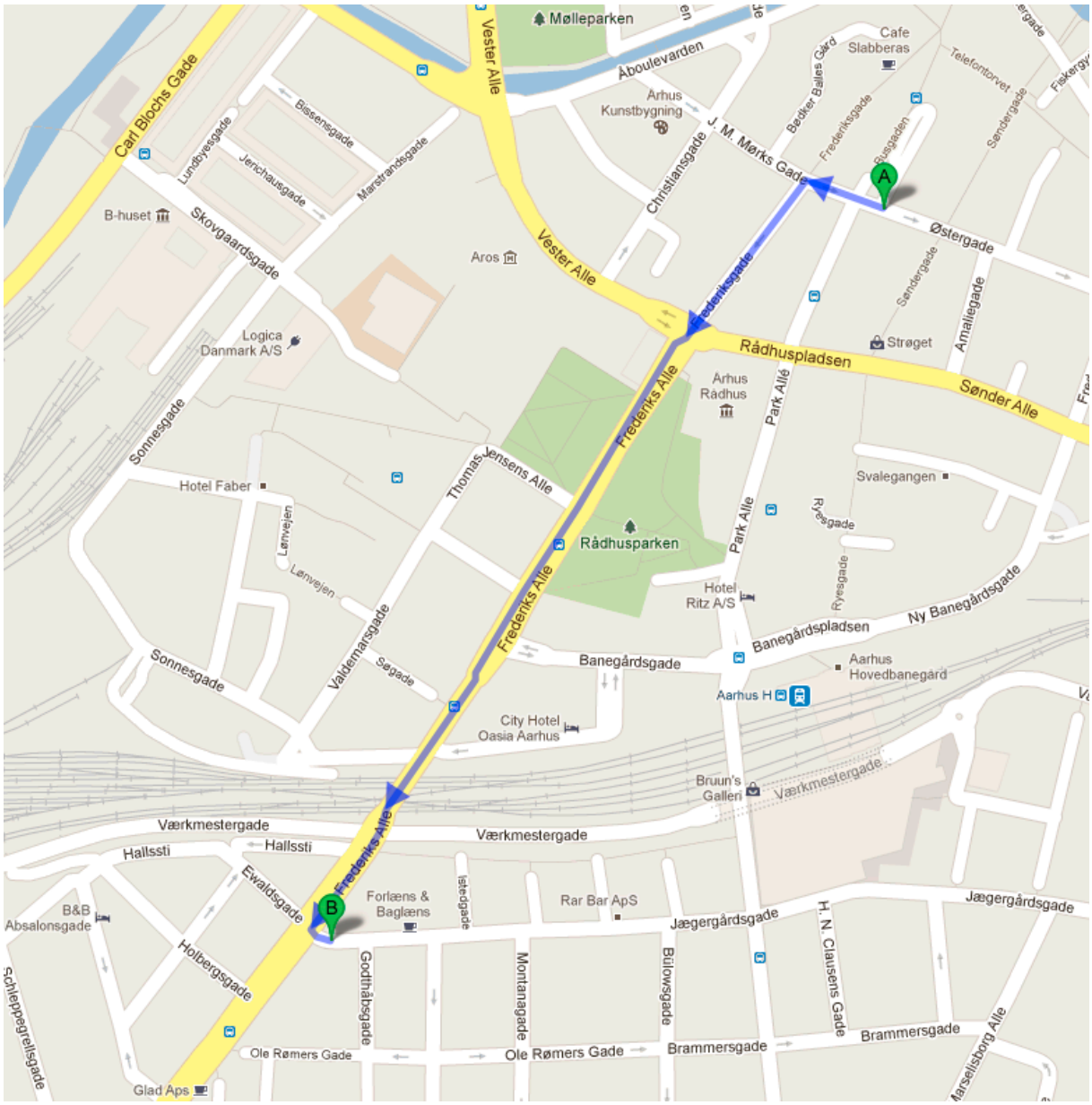
Styrelsen for Forskning
og Innovation
Ministeriet for Forskning, Innovation
og Videregående Uddannelser

Sapere Aude

If you are arriving on or before Sunday evening in time for dinner, please join me at the **Pizzeria Stromboli** (www.stromboli.dk) for a casual pre-conference get-together from 1900. Stromboli is merely a short walk away from the hotel:



The conference dinner on Monday evening will take place at **Nordens Folkekøkken** (http://nordensfolkekoekken.dk), a restaurant serving New Nordic food. Again, it's a short walk from the hotel:



For those of you who want to also explore Århus beyond the hotel and campus, check the city's tourist information here: www.visitaarhus.com/international/en-gb/menu/turist/aarhus.htm.