SAPIENCE

CENTRE FOR EARLY SAPIENS BEHAVIOUR

UNIVERSITY OF BERGEN

ANNUAL REPORT 2019

Norwegian Centre of Excellence

STATEMENT FROM THE CHAIR OF THE BOARD

Current research policies emphasize interdisciplinary research. This is clearly stated in documents from The Ministry of Research in Norway and from the Norwegian Research Council. It is also evident in the EU's upcoming Horizon Europe program. The demand for interdisciplinary research is partly due to a political interest in making science and research useful for the benefit of a society facing multi-faceted challenges.

Sceptics will claim that this idea of political usefulness could interfere with the autonomy of science, which is reliant on the interest-free activity of traditional research disciplines. In light of this important debate, we need examples of interdisciplinary research that is conducted with the highest regard to traditional disciplinary excellence while fostering a spirit of cooperation and mutual inspiration that gives an extra dimension to a project as a whole. This ideal often proves surprisingly hard to achieve, but my impression is that this is exactly what the SapienCE centre is striving for - and already delivers. SapienCE represents interdisciplinarity as it should be - where researchers inspire and influence each other without having to compromise with the traditions and standards of their own disciplines. This is no easy task and it certainly requires long-standing dialogue, patience and creativity within a safe and inclusive research environment. Surely, researchers in such a process will sometimes feel that they are speaking different languages. It is fair to say that SapienCE is still, after its second year, in an early phase, establishing efficient routines, bringing in new staff and further developing a scientific network.

However, at this relatively early stage, the centre has already become an emblem of excellent interdisciplinary research at the University of Bergen. Thank you to everybody who has contributed to developing this groundbreaking, interdisciplinary Centre of Excellence through 2019.

Jørgen M Sejersted

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Overview of Klipdrift Shelter when the University of Bergen rector Dag Rune Olsen and senior members of SapienCE, SapienCE Board and Scientific Advisory Committe visited in late January 2019.

STATEMENT FROM THE DIRECTOR

Effectively 2019 was the second operational year for SapienCE. Over the year, we have moved out of the 'toddler' stages of 2018 and are now maturing into a strongly cohesive research group that is addressing cutting-edge scientific questions. The focus of our research continues to be the origins of early *Homo sapiens* behaviour in southern Africa between 120 000 – 50 000 years ago. Our key questions remain pertinent: When did humans first become behaviourally modern?; What cognitive skills did these people have?; How adaptable were they to climate and environmental change?

To address these questions, the SapienCE team works in a diverse range of disciplines including archaeology, chronology, micromorphology, climate reconstruction and modelling, cognitive and social sciences. The detailed objectives and targets that we set in 2018 have paid dividends in 2019. SapienCE has made considerable progress in terms of attracting PhDs and post-docs, in our number of publications in leading peer-reviewed journals, presentations at conferences, public outreach initiatives, and exhibitions. We also had a highly successful excavation programme, and a number of world-class research groups have proposed collaborations with us in 2019-2020. I detail some of these achievements below.

HIGHLIGHTS 2019

One clear advantage of SapienCE making its mark in scientific circles in 2018 is that we are able to further attract some of the best scientists to join our team in 2019. We recruited one Norwegian Research Council (RCN) funded PhD candidate (Humanities) and three RCN funded post-doctoral fellows in Humanities, Mathematics and Natural Sciences and Psychosocial Science. SapienCE now has ten PhDs and post-docs in our team. In total, we have 28 scientists in SapienCE, excluding scientific collaborators, and eight administrative staff contributing to the running of the centre.

Publications from our existing and newer SapienCE scientists numbered 29 academic papers published in leading journals such as Current Anthropology, Quaternary Science Reviews and Antiquity in 2019. Our scientists made 36 presentations at national and international conferences. A special effort was made to make the SapienCE research available to a wide audience, with 17 popular scientific outputs/outreach events for non-specialist audiences. One of the highlights of 2019 was the opening, by the South African Minister of Tourism, of the joint University of the Witwatersrand/SapienCE "Origins of Early Sapiens Behaviour" exhibition at the Iziko South African Museum in Cape Town in April. The response from the large number of visitors has been very positive and this multi-dimensional exhibition will continue until January 2021.

EXCAVATIONS AND SITE VISITS

Excavations at Blombos Cave took place from 14 January to 22 February 2019. A composite team of eleven SapienCE members (incl. four PhDs/post-docs) were involved in the highly successful excavations, including several 'non-archaeologists' from the climate section of the project. The excavations produced abundant archaeological materials. Samples taken for ancient DNA analysis, leaf wax analyses, luminescence and U/Th dating are currently being analysed. In addition twelve senior members of SapienCE, including the University of Bergen rector Dag Rune Olsen, and SapienCE Board and Scientific Advisory Committee Members, visited the Blombos/Klipdrift sites in late January 2019.

REPORTS, COLLABORATIONS AND EXTERNAL FUNDING

The SapienCE Science Advisory Committee annual assessment was held in Bergen on the 1st November 2019. Prof. Julia Lee-Thorp (Oxford), Prof. Peter Kjærgaard (Copenhagen Natural History Museum) and Prof. Ralph Schneider (Christian Albrechts University, Kiel) served on the panel. The committee's feedback and the discussion between panel members and our scientists was highly positive and helpful for us.

In 2019, SapienCE scientists started nine new collaborations with leading, international research teams. Several of these collaborations emerged from workshops held in Bergen in 2018. As a result of these collaborations, we can report that five pilot studies have been initiated (most currently in the permit applications phase).

SapienCE achieved success in attracting external funding in 2019. Highlights include SapienCE's partnership in a successful Horizon 2020 (Marie Skłodowska-Curie Innovative Training Networks) application that will provide SapienCE with a PhD position, and two UK Natural and Environmental Research Council (NERC) Standard Grant applications that will fund a SapienCE dedicated PhD and a UK based post-doc. All three grants will begin in 2020. In addition, my DST/NRF SARChI Chair at the University of the Witwatersrand was renewed for four years, strengthening research links between the University of Bergen and the South African science community.

My overall impression as Director of SapienCE is how rapidly our Centre of Excellence is maturing and how our dedicated team of scientists and administrators have a steely determination to make SapienCE work. As is the case for all new centres, there have been some teething problems, but we are dealing effectively with these. The result is a stronger centre, more capable of achieving our research objectives in 2020. To conclude, I am confident that our SapienCE team will continue to consolidate and build on the University of Bergen and Norway's position as a world leader in early human origins research over the next eight years.

Christopher Stuart Henshilwood

SCOPE

The SapienCE team has exclusive access to sites that contain the keys for unlocking the past. The unique location of sites dated to between 120 ka and 50 ka on the southern Cape coast, South Africa, a region known to be particularly sensitive to regional and global climatic forces, makes them ideally placed for research into the marine and terrestrial environments utilised by *H. sapiens*.

The inter-disciplinary research teams will carry out a macro- and micro-scale investigation of two new and three existing Middle Stone Age archaeological sites by looking in detail at the evidence, layer by layer, site by site. This will permit the unprecedented integration of securely-dated, high-resolution records of early human cultural, social, technological and subsistence behaviours with global, regional and site-based palaeoenvironmental information. This holistic approach will provide ground-breaking insight into the diverse aspects of what it means to be human.

KEY RESEARCH QUESTIONS

1. When, why and how did humans first become behaviourally modern and how is this defined?
2. Did cognitive changes accelerate behavioural variability?
3. How were these groups of hunter gatherers socially organised?
4. Was social cohesion enhanced by the adoption of symbolic material culture and did it lead to innovation?
5. What cognitive skills had to be in place in order for other skills to develop?
6. How adaptable were humans to environmental change and did climate impacts act as drivers for technological innovation and subsistence adaptations?
7. Can we determine, from our planned genetic research, the relationship of these early *H. sapiens* to extant human populations?

ACTIVITIES

The route down to Blombos Cave from the car park

FIELDWORK

Blombos Cave excavations, southern Cape, South Africa – 14 January – 22 February 2019

Blombos Cave is an archaeological site situated on the southern Cape coast, approximately 300 km east of Cape Town. The cave contains Middle Stone Age materials that date to between 100 000 and 70 000 years ago, as well as Later Stone Age material dating to the last 2000 years.

The Blombos Cave Middle Stone Age layers contain remarkable artefacts that inform us about the origin and timing of the behavioural evolution of our species. Some of these finds include a 100 000 year old ochre processing kit, engraved ochre and bone, the oldest known drawing, bone tools, shell beads, and stone tools which had been intentionally heated to facilitate fine retouch. In addition to cultural artefacts, the faunal and floral remains recovered from Blombos Cave indicate that the inhabitants were well adapted to their environment and employed a diverse range of food procurement strategies.

The site was first excavated in 1991, and in 2019 we conducted our 16th season at the cave. The excavation crew consisted of a core team of 11 SapienCE archaeologists and climate scientists, with several additional researchers visiting for shorter periods. We stayed at the field house, located on a remote area of the coast. Access to the site requires a 2 km hike over a rough coastal path or a drive through the Blomboschfontein Nature Reserve in 4x4 vehicles, followed by a relatively short but steep walk over calcretes and dunes to the cave. All material and equipment, including heavy generators, solar panels and batteries, reach the site via the latter route, and are carried out at the end of the season!

In 2019 our primary focus was to excavate Middle Stone Age deposits at the front of the cave, with the aim of eventually exposing a large area of the cave floor dated to over 100 000 years ago. We started by removing archaeologically sterile dune sand that overlies the Middle Stone Age de-

Blombos Cave

A piece of ochre with incised lines

Excavating and recording inside the cave

posits, and then carefully excavating each of the underlying archaeological layers. The upper layers, dating to between 70 000 and 76 000 years ago, are attributed to the Still Bay phase of the Middle Stone Age. From these layers we recovered numerous stone bifacial points, which are characteristic of the Still Bay phase, as well as a number of shell beads. Well preserved bone, ostrich eggshell, shellfish and ochre were also recovered. Similar materials were recovered from the layers below, but here bifacial points and beads were absent and considerably more ochre artefacts were found.

To produce a long-lasting record of our excavations we employed a state-of-the-art digital recording system specifically developed for the site conditions at Blombos Cave. Nearly a thousand individual artefacts and interesting features in the sediments were plotted in 3D using a Trimble Total Station surveying system. Material that was not plotted was sieved through 3 mm and then 1.5 mm sieves. The fractions retained in each sieve were taken back to our curator at the field house to be washed, dried and sorted into the various categories – stone, bone, shell etc. for further specialist analysis.

In addition to excavation, several samples and datasets were collected by the various specialists who visited the site. These include ostrich eggshell for novel uranium-thorium dating as well as isotopic analyses, soil samples for ancient DNA detection and leaf wax extraction, sand for optically stimulated luminescence dating, blocks of sediment for micromorphology and drone data for landscape reconstruction.
We made good progress towards our goal during the 2019 season, and a number of exciting finds now require careful specialist analysis. Excavations will continue at Blombos Cave in 2020.

Artefacts found at Blombos Cave.

Clockwise from the top right: bone tools; the World's oldest drawing; engraved ochre; bifacial points (centre of the image); shell beads and ochre processing kits.

Members of the Western Cape cultural heritage agencies sit in Blombos Cave listening to Christopher Henshilwood explaining the significance of the site.

Warren Sharp (centre) explains the science behind his newly developed method of dating ostrich eggshell to the excavation team and Sea Change film crew in Blombos Cave

SapienCE SITE VISIT 2019

VISITS TO BLOMBOS CAVE IN 2019

During the 2019 season a number of groups visited Blombos. Some came to understand the significant position of Blombos in South Africa's cultural heritage. Others came to become involved in SapienCE's research program. These visits play an important role in raising public awareness of both our work and Blombos, and in encouraging the wider scientific community to engage with our research.

SAPIENCE SITE VISIT 2019

Several members of SapienCE, including Eystein Jansen and Kenneth Hugdahl, SapienCE Board Members Katerina Harvati and Bruce Rubidge, Scientific Advisory Committee member Julia Lee-Thorp and the University of Bergen's Rector Dag Rune Olsen visited Blombos Cave. Prior to their visit to the cave, they were treated to a traditional South African 'braai' (barbeque) in Still Bay by the Hessequa Society of Archaeology and members of the Gouritz Cluster Biosphere Reserve.

PROMOTING CULTURAL HERITAGE

Members of the Western Cape Department of Cultural Affairs and Sport and Wesgro, the official tourism, trade and investment promotion agency for Cape Town and the Western Cape, visited the cave. These two agencies are working together to promote the cultural heritage of the Western Cape, including discoveries from Blombos Cave, in the form of a route dubbed "The Cradle of Human Culture". Blombos Cave has been nominated for UNESCO World Heritage status by the Department of Cultural Affairs and Sport. While the cave is not open to the public, a small museum in the nearby town of Still Bay showcases some of the finds. A major renovation of the Still Bay museum is planned, to provide a permanent home for the University of the Witwatersrand/SapienCE "Origins of Early Sapiens Behaviour" exhibition, currently on display at the Iziko South African Museum in Cape Town.

VISITING SCIENTISTS AND FILM CREW

Several SapienCE affiliated scientists visited Blombos to collect samples and to gain a better insight into the site. Margit Simon collected soil samples as part of a pilot study to determine whether leaf waxes within the sediment can be used to understand the environments in which the cave's ancient inhabitants lived. Warren Sharp visited to discuss new dates that he has produced from ostrich eggshell from Blombos. Other visitors included members of the Sea Change Project who are producing film footage on the finds from Blombos, as well as people from the local community.

CLIMATE MODELLING WORKSHOP

With the arrival of one of our new post-docs, Ozan Mert Göktürk, regional climate modelling work at SapienCE has commenced in 2019. To talk about the way forward and to enhance collaboration between climate reconstruction and modelling specialists, SapienCE scientists gathered in Bergen for a one-day workshop at the end of August. The focus was on the period around 70 000 years ago, as this is a crucial era for the evolution of modern human behaviour.

In the age of technology, we have both traditional and advanced Earth observation systems, which generate a wealth of precise information. For instance, satellite-based data sets of sea surface temperature, land use, vegetation cover and coastline position can easily be obtained and used by modelers of present day climate. Since these 'parameters' have significant influence on local and regional climate, any information regarding them will help to improve modelling results substantially. However when it comes to paleoclimate research, we have none of this direct environmental information at our disposal. Modelling of ancient climates is highly reliant on environmental proxies derived from natural archives e.g. inferring ancient vegetation cover from pollen preserved in marine sediments.

During the workshop, we reviewed the environmental and climatic proxy data that are already available or being produced by SapienCE researchers for the period of interest. These include the relative abundance of shellfish species at Blombos Cave as a proxy of the coastline distance (Karen van Niekerk), micromammal remains from multiple sites giving clues about changing vegetation cover over time (Turid Hillestad Nel), and sea surface temperatures along the South African coast reconstructed from marine cores (Margit Simon).

The take-home message from this busy day was that we need to ensure that we use all of the available data. Abundant information can be collected from natural archives, and alongside other proxy data produced by fellow scientists in the field, these will help constrain past environmental conditions in southern Africa and enhance the reliability of our climate modelling results.

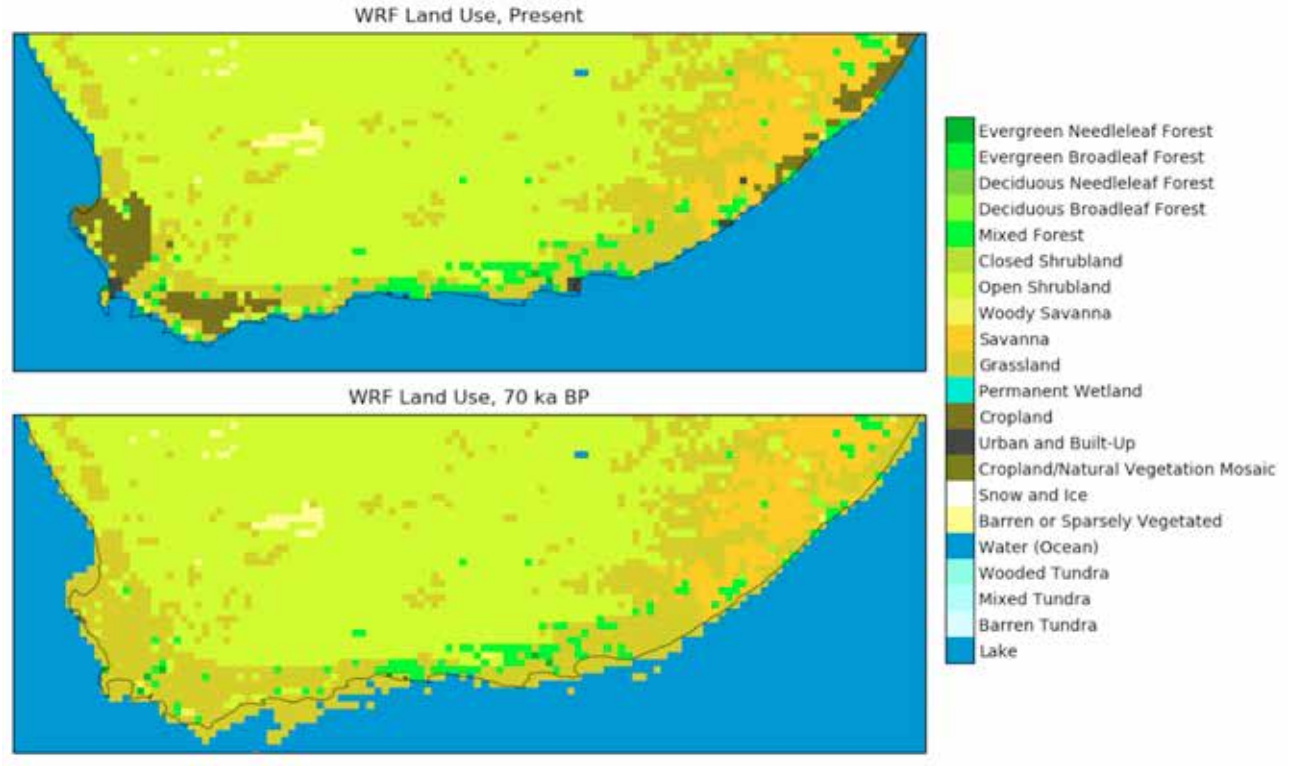


Fig. 1: An example of how our regional climate model, WRF, handles environmental information. At 70 000 years ago (70 ka), sea-level was lower than at present, exposing parts of the sea floor. To ensure that each pixel is allocated a realistic vegetation cover in the model, we need effective collaboration between modellers and paleoclimate reconstruction specialists.

ROSENDAL TEAMBUILDING

11 – 12 September 2019

On a drizzly morning in September, 32 people gathered at Strandkaiterminalen, Bergen, for a 2.5 hour ferry ride through Hardangerfjord to the small village of Rosendal. The group consisted of scientific and administrative members of SapienCE, as well as guest researchers and student volunteers involved in various aspects of SapienCE research. We were on our way to the first SapienCE teambuilding exercise at Rosendal Fjordhotel.

After a hearty lunch the Director opened our first seminar session with an overview of SapienCE, after which we were given a summary of the formal organisation and administration of the centre. This was followed by insights from three of our external researchers, after which group leaders gave overviews of the current state of the art of the various topics (and questions) that form the backbone of the project. This led into a general discussion on future research priorities and strategies for addressing key SapienCE questions.
After the discussion session, the group went on an outing to the Rosendal Barony, established in 1665, and wandered around the wonderful renaissance rose garden. Thereafter we hiked to the nearby Kvinnherad church, a stone building built during the mid-1200s.

On the following day, the PhD and post-doctoral fellows were given an opportunity to present their perspectives of academic life as SapienCE members. This was followed by a very interesting visit to the Folgefonn Centre, led by Eystein Jansen, which showcases exhibitions relating to the importance of the water cycle in the local Hardangerfjord, as well as globally, and the effects of climate change. After lunch, we all hopped back onto the ferry, and returned to Bergen.

View from the quay of Rosendal Fjordhotel

SapienCE director Christopher Henshilwood and AHKR head of department Jan Heiret engaging with the post-docs and PhDs at Rosendal

The Kvinnherad church

Christopher Henshilwood observing the preparation for fMRI scanning at Haukeland University Hospital, Bergen

Kenneth Hugdahl and Christopher Henshilwood in conversation at Haukeland University Hospital, Bergen

A UNIQUE WINDOW INTO PAST COGNITION

Neuroscience provides us with a unique window into the workings of the human brain. In brain-imaging studies using functional magnetic resonance imaging (fMRI), participants are asked to envision as vividly as possible performing a specific task while they are lying in the magnetic resonance scanner. The resulting fMRI data show how blood flow changes in different regions of the brain. Because blood flow to a region increases if that region is in use, fMRI can show us which neural networks are involved in the activity being envisioned by the participant. In our work, we use this method to gain insights into the brain activities of our ancestors by using the modern human brain as a model.

Archaeological findings from the SapienCE sites tell us that our Middle Stone Age ancestors spent time on knapping stone, threading beads, and producing engravings. To infer which areas and neural connections were activated in their brains when they engaged in these tasks, present-day participants are asked to envision engaging in these same activities. Measuring their cerebral blood flow with fMRI will enable us to gain new insights into the parts of the brain that need to be connected to each other during these activities. The fMRI studies will improve our understanding of the cognitive functions and processes underlying the production of characteristic Middle Stone Age items, both in present-day and early modern humans.

Do more complex tools require more complex neural networks?

In a study we began this year, we compare the production of different types of stone tools, from the relatively simple Oldowan and Acheulean forms to the more sophisticated Middle Stone Age tools found at Blombos Cave and Klipdrift Shelter. Our participants are experimental archaeologists, who are experts in producing exactly those tool types. While they envision each step in the different production processes, their brain activities will be measured in a magnetic resonance scanner. This will allow us to identify the distinct neural networks that are involved in each of these steps and to chart the changes in neural networks that are linked to an increased tool complexity.

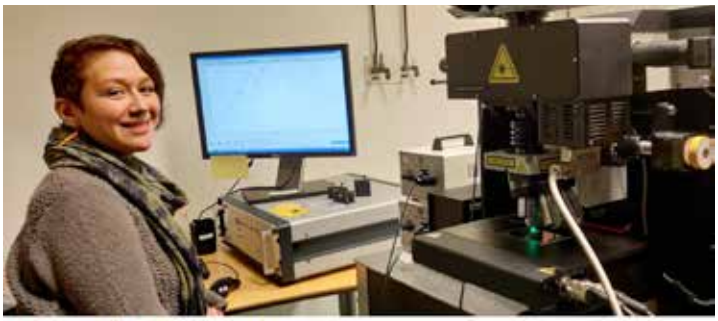
What processes sparked off symbolic representations?

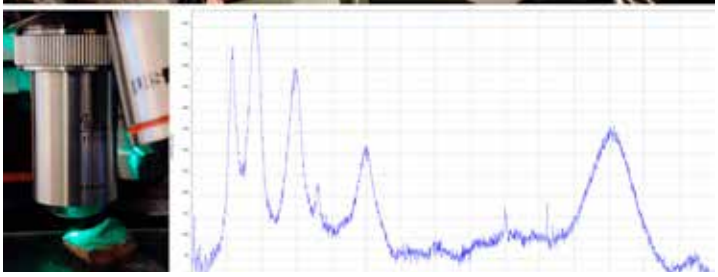
In another fMRI study (published in 2019), present-day participants were shown different types of visual stimuli: pictures of natural scenes, objects, an unknown script, familiar words, and – importantly – engravings from Blombos Cave and other contemporary sites. The brain imaging showed that the engravings were perceived not as random scratches, but as organized graphic entities. Moreover, the activation of brain networks that are involved in language processing suggests that these engravings are perceived as representational. Because this finding contradicts a view that engravings like those found at Blombos merely reflect a proto-aesthetic awareness in humans, it has initiated a fruitful scientific exchange that sets the stage for further refining of theoretical claims and testing them against empirical data.

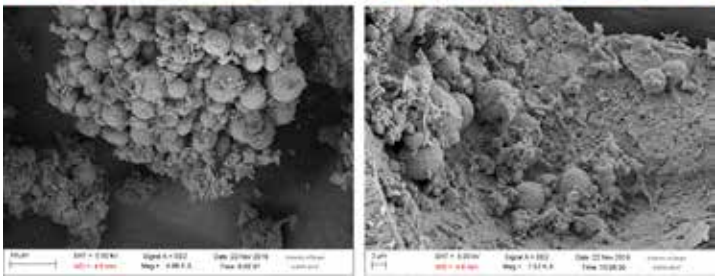
Tying in with this research, a new project (additionally supported by a grant from the John Templeton Foundation) aims to shed more light on the symbolic capacity in human evolution and development. Using data from archaeology and from comparative and developmental psychology, this project will examine evidence for mark-making behaviour across species. From an archaeological sample of cut marks made by different (now extinct) hominins, we will devise criteria to assess whether it is justified to attribute intentionality and symbolic meaning to early engravings such as those from Blombos Cave. Further, comparative studies on marking and drawing behaviour in great apes will look into differences in motor and perceptual abilities in order to point out possible human adaptations involved in visual symbol-making. Lastly, studies with children of different ages will focus on changes in tool use during the production of visual signs, and its correlation with the onset of symbolic thought in activities such as play and storytelling. By studying the production of symbols by different species, and over time within our own species, this project attempts to provide evidence for the early emergence of complex cognition in our lineage.

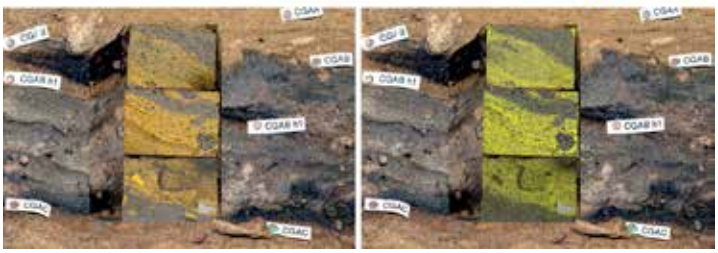
How important was beauty for early humans?

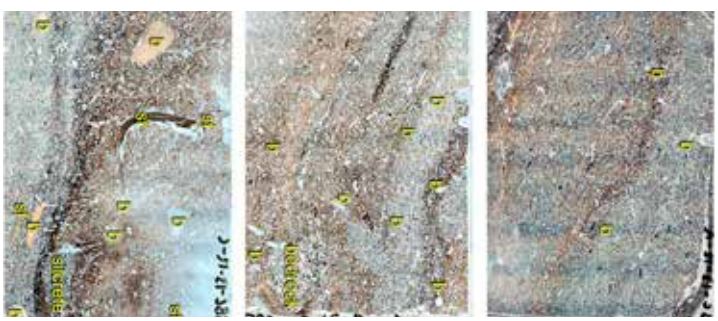
Another line of research aims at investigating the proposed proto-aesthetic awareness in early humans. Did the stone tools produced in the African Middle Stone Age have an aesthetic dimension? Were they deliberately made beautiful, and to what extent did aesthetic motivation affect the production process? A pilot study based on a questionnaire suggests that present-day participants do regard the more complex tools as more aesthetic. This research will be extended to include the marine shells found at Blombos in 73 000 year old layers. We already know that these shells were perforated, threaded on strings, and worn. Whether they may have had symbolic functions other than being used as beads is a question to be investigated in this project.











MULTI-DISCIPLINARY ARCHAEOLOGY WITH-IN SAPIENCE

In Palaeolithic archaeology today, it is not only the immediately and intuitively recognized archaeological material that is given attention. Smaller and more ambiguous material is also thoroughly investigated, often by using analytical methods and techniques that were originally developed in other disciplines. As such, the archaeology program within SapienCE has been specifically designed to facilitate high-level interdisciplinary analysis of the archaeological assemblage associated with the sites currently being excavated.

What material did you study in 2019?

Silje Evjenth Bentsen (post-doctoral fellow): One of several types of materials I have been focusing on in 2019 is ostrich eggshells (OES). Several hundred fragments of OES has been found in Klipdrift Shelter and been dated to be between 65 000 and 60 000 years old. Some of these fragments have been decorated with geometric patterns, so it is clear that prehistoric people both used and valued them. The question is: What exactly did they use OES for? Many of the OES fragments from Klipdrift Shelter appear burnt and in one of my experimental archaeology projects I am trying to find out whether ostrich eggs could have been intentionally exposed to heat, for example while being used as cooking vessels. An alternative explanation for the presence of burnt OES could be that they were unintentionally embedded in or under a fire.

Elizabeth C. Velliky (post-doctoral fellow): For the last few years, I have worked on prehistoric pigments and the ways in which people used them and constructed their lives around them. Specifically, I study red ochre, an iron-rich material that is found at archaeological sites all over the world, and is still used today in many societies, especially in Africa. At Blombos, several thousand pieces of ochre collected over tens of thousands of years show that people thought these bright red coloured rocks were special and important. In my research, I focus on the aspects of ochre that can offer definitive information, for instance where people were collecting it in the landscape, how these collecting behaviours changed over time, and how people may have used ochre for colouring beads or for hafting tools.

Magnus M. Haaland (post-doctoral fellow): My research focus is on cave sediments and everything that can be found in them. In 2019, I started an in-depth analysis of a particularly difficult part of the archaeological sequence in Blombos Cave. Within this sequence, which is more than three meters deep, there is a ~20 cm thick black and burnt layer that archaeologists have known about for years, but never understood. Being more than 7 m^2, it was certainly not a fireplace, and it doesn't look like anything else ever recorded within the site either. This "black lens" is a true archaeological puzzle, and one dated to ca. 84 000 years ago.

What do we already know about the significance of this material?

Silje Evjenth Bentsen: We know from both historic and ethnographic sources that ostrich eggs (OES) can be cooked whole and the contents of the egg eaten, and that the emptied eggs can be used as water flasks or containers. In modern contexts these OES containers are also decorated with detailed patterns or drawings, often indicating which group or family it belongs to. Another way to use OES is to shape it into round perforated beads, and wear them as stringed bracelets, necklaces or as earpieces. However, different hunter-gatherer groups have different traditions for making drinking vessels and personal ornaments. Some group use OES for a range of things, while others do not use them at all. This is important to keep in mind when we study the prehistoric engraved OES from Middle Stone Age contexts, such as Klipdrift Shelter.

Elizabeth C. Velliky: Ochre is a fascinating material. Humans have been collecting and using it since at least 280 000 years ago. However, ochre use became widespread at about 160 000 years ago in Africa. Ochre and pigments are found on every continent that humans have inhabited. It was used in a number of different ways for different applications, such as for colouring certain artefacts, for medicinal purposes, and perhaps for many other reasons that we do not yet know. Because ochre is not necessary for biological survival, humans perceived and interacted with it in a different way, likely for ritualistic or symbolic reasons. By unlocking the intricacies of pigments and the ways humans structured their lives around them, we can start to gain insight into aspects of early behaviour that we cannot see with other archaeological materials.

Magnus M. Haaland: When archaeologists find artefacts in the field, it is not only the information from the physical object that is important to document. Often, it is the location and context in which we find the original artefacts that can give us the best clues about how prehistoric humans used these artefacts and for what reasons. Because the black lens at Blombos is such a large feature within the cave, and because archaeological artefacts have been found within it, it is important to identify what these sediments are made of and how they formed.

What analytical technique do you use to study this material more in-depth?

Silje Evjenth Bentsen: Since one of my questions about Middle Stone Age OES is whether they were intentionally exposed to heat or not, I am currently investigating how this material responds to heating. I am particularly focusing on documenting any microscopic structural changes that may occur within the shell due to increasing temperatures. For the analysis of inner structure of OES I have been using Scanning Electron Microscopy (SEM). By documenting heat-induced alterations in OES that has been heated to known temperatures in the laboratory, I hope to better understand whether an egg was either directly exposed to heat (on a fire during cooking) or whether it was more indirectly exposed to heat (e.g. within sediment under a fire). Being able to demonstrate either hypothesis has important archaeological implications, telling us either how people used vessels for storage or preparation of drink or food during the MSA, or revealing the post-depositional effects of fire.

Elizabeth C. Velliky: I have used a variety of different analytical techniques to characterize ochre materials, specifically in regards to their geochemistry and mineralogy. One technique that is particularly useful for iron oxides is Raman Spectroscopy. This technique can identify specific mineral phases present in a material, which, coupled with other geochemical techniques such as Neutron Activation Analysis (NAA), can ultimately inform us about the types of ochre people used and where they collected them. In the past, I used micro-Raman spectroscopy to identify anthropogenic ochre residues on artefacts, and with other geochemical techniques such as NAA and X-ray Diffraction (XRD), I was able to identify regions where people collected ochre materials and how these behaviours changed over time. I plan to use a similar strategy for studying the Blombos ochre – to see what types of ochre people collected, why, where, and how they used it.

Magnus M. Haaland: I have used several micro-analytical techniques to characterize the microstratigraphy (soil micromorphology), mineralogy (micro-FTIR, micro-Raman spectroscopy), elemental composition (XRD, micro-XRF) and grain morphology (SEM) of the black lens at Blombos. In addition, I have sent sediment samples abroad for soluble salt analyses and gas chromatography–mass spectrometry. While some results are not yet available, it is clear that the depositional processes that created the black lens are more complex than expected. Indeed, it is probable that humans did not create it. My investigation will continue in 2020.

CLIMATE

In 2019 we continued addressing one of the main SapienCE questions, namely "How did climate affect the behavioural evolution of early *Homo sapiens* in southern Africa?" Our approach to answering this question is based on a combination of paleoproxies, which tell us about past conditions e.g. temperature, and numerical climate modelling. As part of our work on palaeoproxies, we have retrieved the first data from analyses of marine sediment cores taken from off the South African Coast.

These sediments contain fossil material that derives from both terrestrial and marine environments, enabling us to reconstruct variations in ocean temperatures, as well as changes in the hydrological cycle on land. Our work has focussed on sediment from two time periods, 73 000 to 70 000 years ago and 50 000 to 48 000 years ago. From the first analyses of the pollen it is clear that the marine sedimentary archive contains a record of vegetation changes that are likely the results of variations in precipitation over land.

In early 2020, SapienCE team members will be part of the crew of a French research ship, the Marion Dufresne II, which will mount a coring campaign off the coast of South Africa. This research cruise will probably recover new, longer, sediment cores that will allow us to extend our climate reconstructions further back through time.

We have also obtained the first results from the analysis of speleothems (stalagmites and stalactites) from Bloukrans Cave. Using the FARLAB laboratories at the University of Bergen's Department of Earth Science, two different temperature proxy methods, fluid inclusions and clumped isotopes, have been tested in parts of the speleothems covering interglacial (Holocene, the last ~12 000 years) and glacial (MIS3, ~57 000-29 000 years ago) periods. Reconnaissance dating of new speleothem samples show that Bloukrans Cave also contains material covering the past 90 000 years.

Additional fieldwork, to recover new material from Bloukrans, will take place in early 2020. In our numerical climate modelling work, we have started down-scaling the results from the global climate simulations, using a more detailed model for the southern African region. The down-scaling work will allow us to simulate landscape changes in the different time intervals during which the SapienCE archaeological sites were occupied by our ancestors. In collaboration with an external partner, we plan on adding agent-based modelling to our toolbox, which will permit modelling of human migration and dispersal.

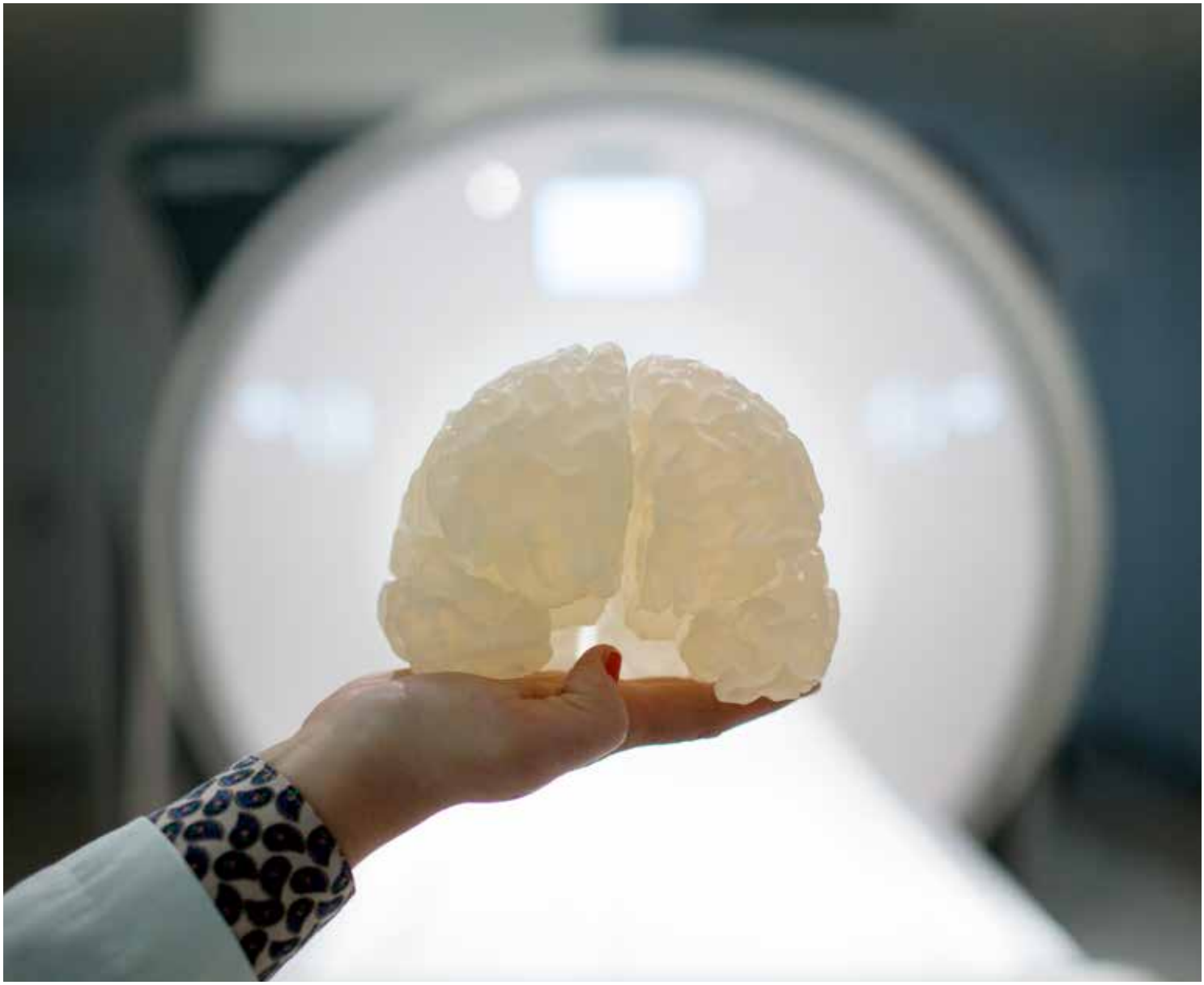
Wits´ master student Inèz Faul receives SapienCE poster after presenting her project in Bergen.

Shellfish remains from Blombos Cave: operculum of *T. sarmanticus* later to be used for climate reconstructions.

Nele Meckler placing samples for clumped isotope analysis in the mass spectrometer at FARLAB, UiB.


SapiensCE has access to some of
the best preserved, rare sites
occupied by early Homo sapiens
after c. 120 000 years

STORIES



THE CULTURAL ROOTS OF HUMAN COGNITION

The hominin line shares most of its genetic makeup and a great deal of its behavioral repertoire with its closest primate relatives. At some point in the past, however, it set off on a different evolutionary trajectory, culminating in cognitive skills that are impressive both in extent and in the speed at which they have evolved. One goal of SapienCE is to shed light on when this process began and what triggered it. One insight gaining general acceptance is that the human capacity for culture played a key role in the evolution of our cognitive skills.

Two major roots of human cognition are curiosity and sociality: In general, *Homo sapiens* – like the SapienCE scientists in this picture – tend to be interested in what is going on in the world, including what others think; they are willing to share their thoughts with others; and, with language, they have a powerful tool at their disposal for doing so.

The capacity for culture is tightly linked to a predisposition for collaborating with the members of one's social group. As demonstrated by Tomasello and colleagues, this rests on a range of characteristics that are especially pronounced in humans: a keen interest in what others think and believe, a willingness to share one's thoughts and beliefs, from simple communication to explicit teaching, and the faculty for language, which provides the tool for doing this efficiently. Jointly, these characteristics lay the ground for the accumulation of knowledge in unprecedented ways.

The role of culture and evolution for human cognition

Cumulative culture as defined by Tomasello is one of the main driving forces in the evolution of human cognition: by ratcheting up cultural innovations, promoting new cognitive skills, rewiring brain networks, and even shifting gene distributions. In SapienCE, we take this idea one step further. Humans gain access to an ever-increasing body of knowledge and beliefs because they are willing and able to learn from other members of their social group. What they know and believe also affects what they perceive, how they remember, and which inferences they draw. In other words, it shapes their cognition.

As detailed in a recent paper, this impact of cumulative culture on cognition has two implications. The first is that evolutionary processes have not stopped but are still active in shaping cognitive behavior. For instance, an interest in quantities led people to invent cognitive tools for counting, which then enabled simple calculations; once addition was in place, multiplication came into reach, which paved the way for exponentiation and functional calculus. Today, global dotcoms develop powerful algorithms to measure, predict, and manipulate the preferences and choices of their users. The other implication of cumulative culture is that it promotes diversification, including in cognition. Returning to the above example, counting systems therefore differ substantially across languages and cultures.

While such an evolutionary perspective improves our understanding of present-day cognition, it can also be harnessed to investigate past cognition. The central idea here is that retracing the diversification process allows us to reconstruct ancestral states. Charting diversity also helps us to identify shared features, both now and then: The more widely shared a feature is today, the more likely it was also present in, or at least available to, our ancestors.

The cultural fabric of human causal cognition

In a second paper published in 2019, this strategy for investigating past cognition was applied to causal cognition, that is, the processing of information on cause–effect relations, from perception to problem-solving.

Causal cognition is relevant for understanding why (and ideally: how) an event happened, for predicting which outcome it will lead to, and for designing interventions that successfully change its course. This makes it indispensable for developing and refining tools, for grasping the role of weather conditions and environmental features for subsistence and navigation, or for improving measures to prevent and treat illnesses. Asking why-questions, and seeking to answer them, lies at the heart of science, technology, and religion. For these reasons, some scholars even consider a concern with causality as the main driving force in human evolution.

The review of available literature yielded two key insights: Causal cognition involves a number of components that are phylogenetically old and widely shared across species; in humans, however, it is also profoundly shaped by culture. Being able to harness one's understanding of cause–effect relations for changing one's niche is in fact so advantageous that the foundations of this cognitive ability evolved independently in species such as primates and corvids. In contrast to their non-human relatives, however, humans do not just ponder about causal mechanisms behind the patterns they observe, but also absorb enormous amounts of causally relevant knowledge. This is partly organized in cultural models and theories, which in turn affects how humans perceive and reason about cause-effect relations.

Based on this analysis, it is safe to assume that early modern humans possessed the same cognitive toolkit for dealing with causality that present-day humans have in common with their closest relatives. In addition, we can, with some degree of certainty, ascribe to our ancestors a willingness to share causal information, to actively teach and learn from teaching, and even the ability to infer valuable information from one's assumptions about other people's knowledge. Beyond this shared core, causal cognition would be moulded by culture. For drawing any further inferences, additional data are therefore needed, deriving, for instance, from the artefacts that our ancestors produced and used, or from insights on how they interacted with their environment.

The extent to which causal cognition would have been shaped by the cultural transmission of knowledge and beliefs also, and in fact crucially, depends on whether these people already had a full-fledged language at their disposal. Astonishingly enough, this is another key question that has remained open – and one that we in SapienCE plan to address in future work.

RECREATING THE LIVES OF OUR ANCESTORS

New digital technology makes it possible to recreate the lives led by our ancestors 100,000 years ago.

Imagine the scene 100,000 years ago. A group of hunters are strolling along the beach at Blombos near Cape Town. They are carrying fish and shellfish that they have caught at the coast nearby. Together they continue their journey, climbing up the steep slope towards the cliffs. On the way they discover an opening in the landscape. It turns out that they have found a cave, large enough to accommodate the whole group. They go in, light a fire, cook some food and settle down. The cave becomes their home.

Could this be how our South African ancestors discovered Blombos Cave and made it their home 100,000 years ago?

New technology allows new interpretations

– Yes, perhaps it was like that, says Ole Fredrik Unhammer with a smile.

We meet Unhammer during field work at Blombos Cave, about 250 km east of Cape Town in South Africa. He is part of the interdisciplinary SapienCE team at the University of Bergen, which is researching the behaviour of early humans. Together they are looking for answers as to when, how and why our species began to communicate using symbols such as paint, engravings and jewellery such as shell beads. In short, how did we begin to think and behave like we do today?

"Archaeology is a science that combines facts with interpretation. It's hard to say anything with 100% certainty. It is therefore important to have good documentation methods that can create a solid basis for interpretation, Unhammer explains.

He is using a digital documentation method that is designed to produce realistic photographic 3D models of both the Blombos excavations and everything that is found there. In this way, the elements of the settlement can be fitted together and examined from several different perspectives.

"It's very exciting to work this way because it allows for completely new interpretations which give us a better understanding of how people lived their lives in the cave," says Unhammer. He hopes that in time they can recreate life in the cave by displaying the finds they have excavated in a virtual world.

Life in the cave

"Archaeology is basically a destructive science. We excavate to find out how people lived in a period well before historical records. We are looking for activity and analysing objects, remnants from hearths and living spaces to understand more about how they organised themselves in the cave. To understand how a settlement was created, we have to "dismantle it". Therefore, it is important to document everything just as it was, and where things were located when we found them. With our method, we can use the 3D models to "assemble" the settlement as it looked when we found it, and to create a more holistic understanding of the environment, "Unhammer explains.

When they dig in the cave they work their way down into the sediment layer by layer. Each cultural layer is naturally defined with a variety of colours, consistency, and content, and tells a new story about the people who lived in the cave.

How did we become who we are?

"Some of the layers we have excavated give us a sense of walking into the lives of those who have lived here. The objects we find have been left completely untouched, protected by sand, since they last used them. They might be tools, or scraps of food. Through our surveys, we can also find out where they had their hearth - or what we would call the kitchen today, says Unhammer with a smile.
He has just started work on his doctoral degree. In this work, he takes the documentation method one step further. Now the landscape outside the cave is also going to be documented as well.

New specialist on the team

Unhammer uses a drone to document the landscape. With a steady hand, he navigates the SapienCE drone on photo assignments.

"It has a good range and many advanced features, but it is still important to take care, so that we do not damage the equipment or disturb the wildlife in the area," Unhammer explains. He has just started to discover what the drone is capable of doing and does not yet know the results of this work.

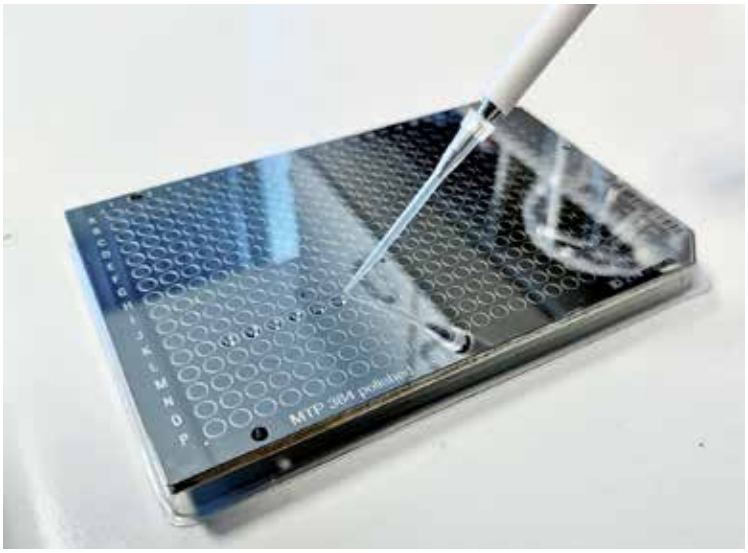
"We hope to be able to recreate the landscape around the cave, as it looked 100,000 years ago. Our aim is to obtain more information about what the landscape looked like, and in what way the vegetation, wildlife and climate have changed over time. Such knowledge will give us a more complete picture of life in the cave, because we can see it in the context of the environment outside", says Unhammer.

COLLABORATION – ANCIENT DNA

Matthias Meyer
Department of Evolutionary Genetics, Max Planck Institute for Evolutionary Anthropology
Leipzig

In the last few years, increasing numbers of DNA sequences have become available from ancient hominins, including full genomes from Neandertals, Denisovans and early modern humans. Unfortunately, no human DNA older than ~15,000 years has been recovered from Africa due to the non-optimal climatic conditions for long-term DNA preservation and the scarcity of hominin remains. Our recent discovery of the preservation of ancient hominin DNA in cave sediments now opens the opportunity to attempt DNA retrieval from many more sites and archaeological layers than was previously possible. This work can also take place without destruction of precious hominin fossils. We hope that the analysis of sediment DNA will ultimately make it possible to study hominin evolution and dispersals by means of genetic analysis of archaeological sites across the African continent. Working on cave sediments from the SapienCE archaeological sites is an important first step towards this goal. SapienCE also makes it possible to interpret our genetic analyses within a comprehensive multi-disciplinary investigation of human evolution.

Automated liquid handling system (Bravo NGS workstation, Agilent Technologies) used for preparing ancient DNA from sediments or skeletal remains for sequencing.



COLLABORATION – ZOOMS

Katerina Douka, Group Leader and Principal Investigator "FINDER" Project
Department of Archaeology, Max Planck Institute for the Science of Human History
Jena, Germany

In the spring of 2018, we met in Bergen with members of the SapienCE team and agreed that undertaking proteomics analyses of faunal material from several South African Middle Stone Age sites, had the potential to answer fundamental research questions such as: (i) who made the material culture found in the archaeological layers of sites such as Klipdrift Shelter or Blombos Cave, (ii) what were the subsistence patterns (hunting strategies) of these groups of hunter-gatherers and (iii) what was the natural environment like 100 000 to 50 000 years ago?

Due to the fragmentary nature of mammal and micro-mammal bones recovered from many archaeological sites, identification is often limited to a small number of samples preserving clear diagnostic features. However, using a biomolecular approach called collagen fingerprinting, or ZooMS for short, we can now potentially identify small undiagnostic bone fragments quickly and relatively cheaply. However, we knew that the preservation of biomolecules in South Africa might be a limiting factor, which could hamper our analytical efforts.

In a feasibility study in the autumn of 2019, and in close collaboration with SapienCE post-doctoral fellow Turid Hillestad Nel, we were able to extract and fingerprint collagen from 23 (of the 72) samples analysed in our ZooMS laboratory at the Max Planck Institute for the Science of Human History in Jena, Germany. While this number may sound small, it is extremely exciting that 50 000 to 60 000 year old micromammal bones from South Africa preserve collagen. Continuing this work in 2020 is crucial if we are to unlock the full potential of these important sites and help the SapienCE team to answer fundamental questions about the origins of early human behaviour.

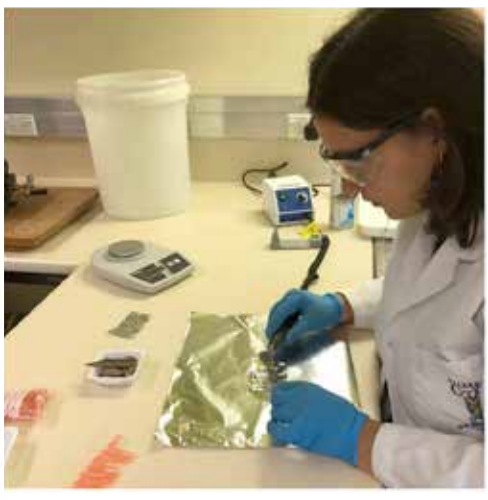


Fig. 1 : Estimates of land extent in southern Africa at around 70 000 years before present (70 ka BP), after Spratt and Lisiecki (2016).

Spratt, R. M. and Lisiecki, L. E.: A Late Pleistocene sea level stack, Clim. Past, 12, 1079–1092, https://doi.org/10.5194/cp-12-1079-2016, 2016.

Fig. 2 : WRF model surface air temperatures near Blombos Cave through an arbitrary winter month, 70 000 years before present. The model was run twice, once with the present day coastline (blue curve) and once with the coastline defined by the lowest sea level estimate at 70 000 years ago i.e. with the coast further south, away from Blombos Cave (red curve). Note the much lower night-time temperatures and larger diurnal range calculated when the coast is further south (red curve), due to the reduced marine influence.

DECIPHERING ANCIENT CLIMATES

One crucial component of the climate reconstruction work within SapienCE is climate modelling. By using global models, we can simulate the characteristics of large scale atmospheric circulation and obtain, for example, the temperature and distribution of precipitation on the Earth's surface 65 000 years ago. However, the level of spatial detail (i.e. horizontal resolution) in global models is quite low, thus providing us with a rather poor estimate of what was going on regionally and locally.

To overcome this problem, we use a 'regional model', which runs on a predefined, limited area. The regional model uses the output from the global model as its input, and generates output on a much smaller scale – hence we describe this process as 'downscaling'. Yet, this is not some kind of interpolation to redistribute low-resolution data statistically: The regional model uses atmospheric physics and dynamics to calculate all meteorological variables for each grid cell almost from scratch. Even on supercomputers this 'dynamical downscaling' takes a lot of time.

We use the output from the Norwegian Earth System Model (NorESM) global model to perform dynamical downscaling in the Weather Research and Forecasting (WRF) regional model. The NorESM data points (i.e. centers of grid cells) are ~400 km apart, giving coarse spatial resolution data which is not very useful to assess regional and local climate. The WRF model downscales NorESM output to a horizontal resolution of 12 km. This allows us to derive much more robust interpretations of model output, and makes it possible to compare this more detailed information with proxy records of climate within the model domain. In short, we can assess the quality of both model and proxy data by comparing them.

However, setting up a regional model to simulate past climate is not as straightforward as it might sound. The model uses parameters such as vegetation cover, coastline position and sea surface temperatures in its calculations, most of which are readily available for the present day. Unfortunately this is not the case for the past. For instance, the Earth was in an ice age between 50 000 and 100 000 years ago and the sea level was lower, so a lot of land area that is submerged today was exposed then. This has important implications for climate at coastal sites such as Blombos Cave, since the presence or absence of marine influence may lead to dramatic differences in temperature and precipitation patterns.

With great challenges come great opportunities. Using a regional model, one can determine how sensitive the local climates are to these long-term changes on the Earth's surface. This is achieved by running the model several times, each time modifying a parameter that we are uncertain about. For example, we could lower the sea level and run the model with this new 'setting'. By comparing the output from several runs conducted using different settings, we can determine the sensitivity of the model to sea level, and therefore how accurately we need to know past sea-level to get a good model result. Similar sensitivity simulations can be designed for other parameters, which helps us to understand what the more important factors in deciphering past climates are.

All this work has commenced in 2019 and is still in progress. Preliminary results show that paleo-coastline and paleo-vegetation might have had significant impacts on local climates in southern Africa. We plan to focus on the regional changes from 82 000 to 70 000 years ago, which is an important period for the evolution of modern human behaviour.

Fig. 1

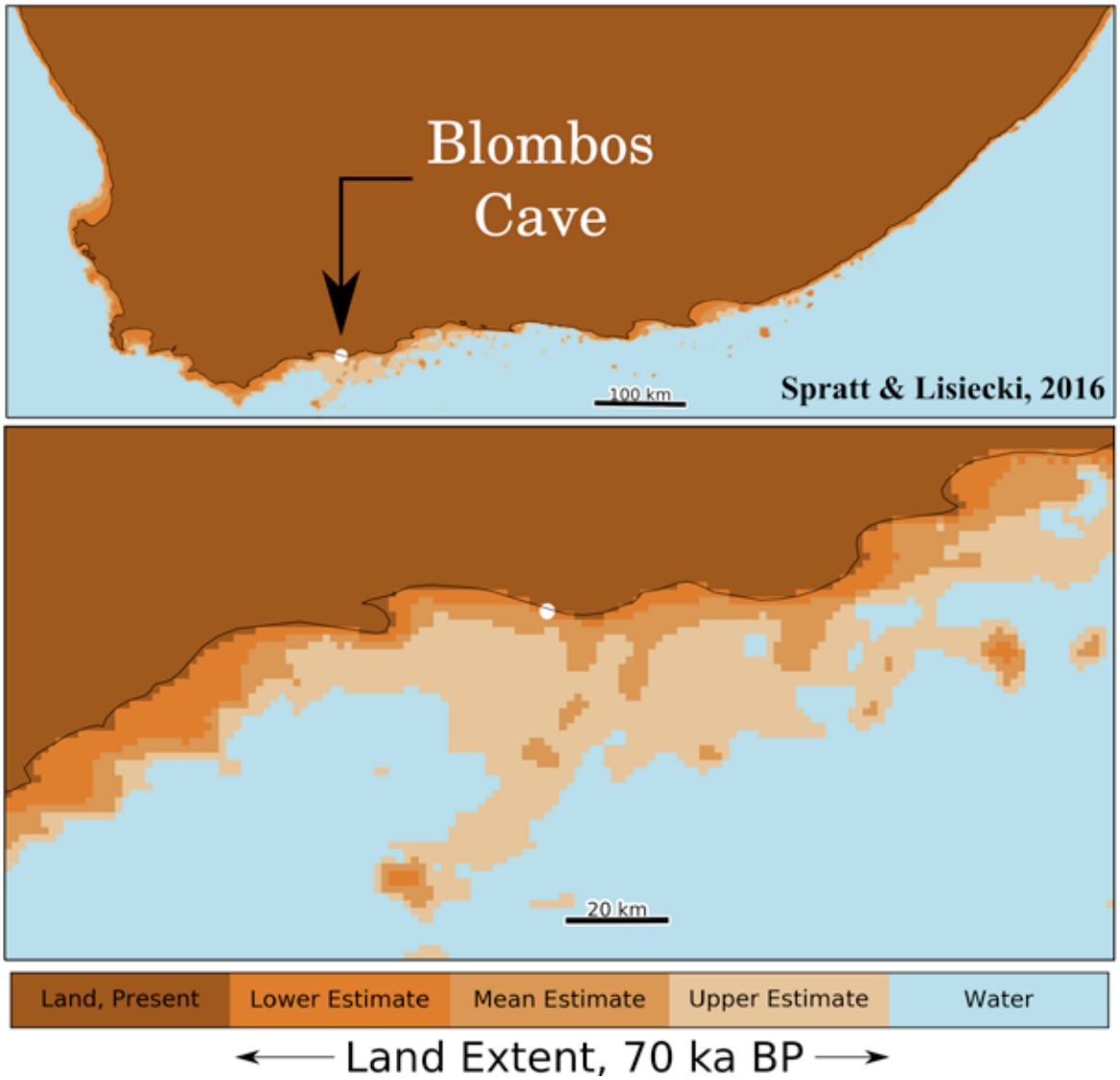
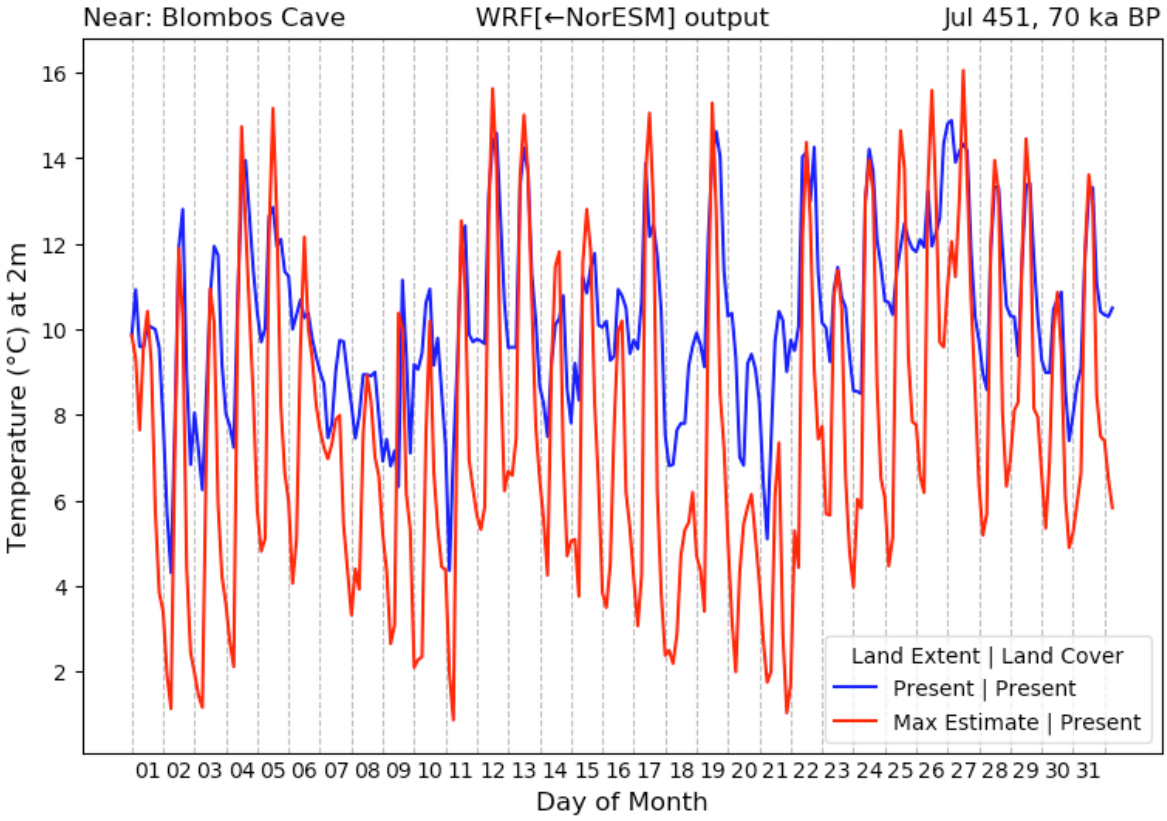

Blombos
Cave
100 km
Spratt & Lisiecki, 2016
20 km
Land, Present
Lower Estimate
Mean Estimate
Upper Estimate
Water
Land Extent, 70 ka BP

Fig. 2


Near: Blombos Cave
WRF[←NorESM] output
Jul 451, 70 ka BP
Temperature (°C) at 2m
16
14
12
10
8
6
4
2
01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Day of Month
Land Extent | Land Cover
Present | Present
Max Estimate | Present

Overview of Klasies River main site

HOT STUFF FROM KLASIES RIVER MAIN SITE

Klasies River main site, situated on the picturesque Tsitsikamma coast of the south eastern Cape coast, provides unique insights into the long history of *Homo sapiens*. The site contains 21 metres of well-preserved hunter-fisher-gatherer archaeological remains dating to between 120 000 and 45 000 and also 23 000 to 4800 years ago. At present the remains of more than 50 humans who lived at this site during this time period have been excavated. The dense shell middens, stone and bone tools and many hearths provide glimpses into the behavioural and cognitive characteristics of our ancient ancestors. This year no excavations took place and the focus has been on consolidation and publishing new data.

Analysis of fire related phenomena played an important role in this year's publications as excavations and microscopic analysis revealed unexpected finds. One example is the reddened and fractured quartzite fragments found at Klasies River from the 2015 season onwards. Reddening and fracturing of rocks are generally associated with the use of stones in cooking or as hearthstones around the fire. However, since neither hearthstones nor hot-rock cooking were previously found in Middle Stone Age contexts, we conducted a series of experiments to understand how these reddened fractures rocks formed. Silje Evjenth Bentsen explains the experiments on page 36-37. These results were published in the Journal of Field Archaeology in 2019.

But what can heated rocks and fire use tell us about the humans staying at Klasies River? We see that there are different types of fire use at the site. Firstly, there are remains of very small fires. Little time was needed to gather firewood or otherwise prepare for these fires, but they would have died down quite quickly and represent short use. Secondly, there are remains of slightly larger fires, which required more wood and preparations and could be used for longer or by more people. Lastly, the reddened quartzite indicates that people had used time to gather quartzite before starting the fires. The quartzite was heated repeatedly to high temperatures and much firewood was required for these fires. These different types of fire use indicate that people used Klasies River in different ways, from short stays that might just represent an afternoon to longer stays of days or perhaps even weeks. We presented these ideas in 2019 in a book chapter in the book "Architectures of Fire: Processes, Space and Agency in Pyrotechnologies", edited by Dragoş Gheorghiu (Archaeopress).

Another study of hearths dating to between 120 000 and 65 000 years ago revealed that people from Klasies River roasted starchy foods such as roots and tubers. A scanning electron microscopic study of the ashes revealed plant tissue or parenchyma that indicated heating of such foods. This paper, published in Journal of Human Evolution, showed that roots and tubers definitely formed part of the Klasies people's diet, and that they had the foresight to roast these foods, making it more digestible – so much for the idea that the "paleodiet" consisted mostly of protein and fat! We also undertook a detailed investigation of lithic implements from the layers containing the heated quartzite blocks. The lithics are also made from quartzite, and the cobbles from which they were made were not heated. In a paper published in Journal of Archaeological Science Reports, we showed that the knappers were masters of their trade, and that they manipulated oval shaped cobbles to obtain expertly designed points and blades that were further used to process animals, plants, shellfish and fish.

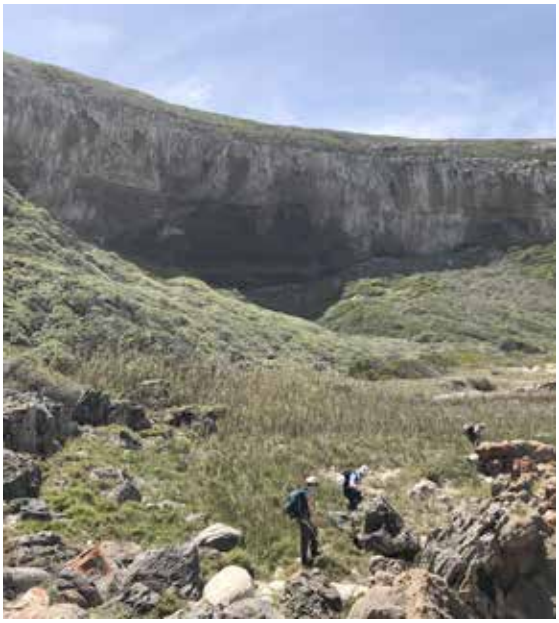
All of these investigations focused on the Middle Stone Age, but an experimental study of a dual holed bone implement from the 4800 year old layers provided a tantalizing glimpse into the soundscape of inhabitants of the cave. We found that this bone implement was very likely a woer-woer, or wirra-wirra, similar to spinning disks that produce a whirring sound when spun. Spinning copies of this implement inside the cave enhances the sound and almost give the impression of the cave breathing. This study was published in Journal of Archaeological Science Reports. We combine studies of the more recent past with that of the present to provide a holistic impression of our ancestors from Klasies River lifeways. We undertook ethnobotanical research to contextualize the palaeo-ethnobotanical finds retrieved from the excavations. In a study, published in the journal Ethnobotany Research and Applications, we show that the Khoi and San people of the region still use many of the plants reported in 19th century sources, and that almost half of these species are also found in archaeological sites.

We are very happy to see that all our journal articles have achieved very high Altmetric scores, which means that they were frequently shared and discussed in social media as well as featured in newspapers and popular science publications. Indeed, four of the journal articles on Klasies River mentioned here were among the top 5% of research outputs ever tracked in Altmetric! It is inspiring to know that our hard work is so useful to others. We are now working on new analyses and finds, so follow the Klasies River research project to see our future publications.

Joshua Kumbani excavating at Klasies River

The team excavating the Witness Baulk at Klasies River Cave 1

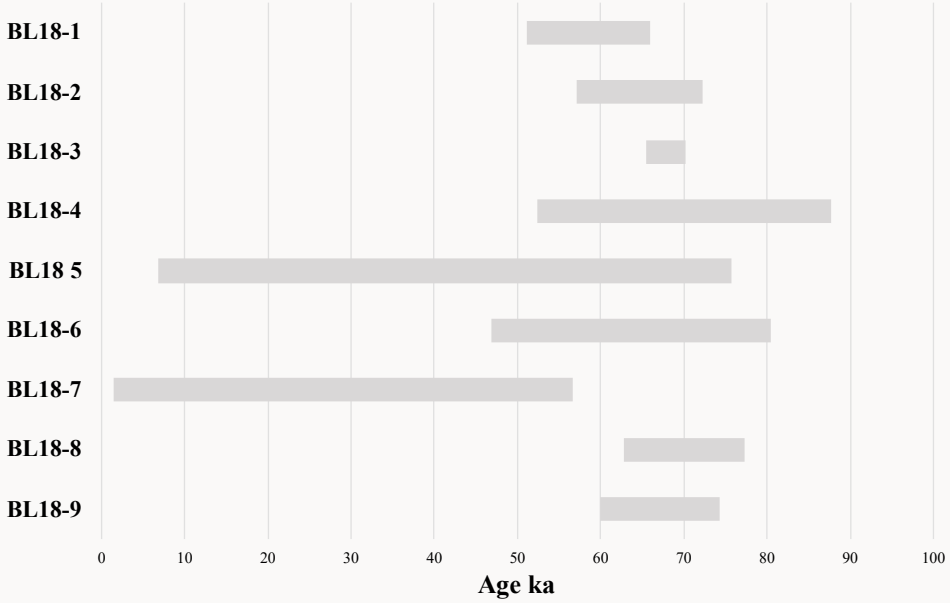
Sarah Wurz during the excavations of Klasies River main site



THE QUEST FOR THE RIGHT SAMPLE

Speleothems (e.g. stalagmites and stalactites found in caves) are excellent archives of past climate change. They form when water drips from the same spot on a cave roof (stalactites) or onto the same point on the cave floor (stalagmites) for thousands of years, gradually building columns of limestone. They can be accurately dated, and they incorporate a number of proxies that can help to understand climatic and environmental changes. However, not all speleothems from a single cave system are similar. They vary in shape, size and growth rate. Even with the best of "educated-guesses", there is simply no way to estimate the age and growth rate of a given specimen in situ. For this reason, we bring samples back to the laboratory to be dated. In our current work, we are focusing on the time interval during which SapienCE archaeological sites were occupied i.e. between 120 000 and 50 000 years ago.

To study short-lived climatic changes, we need to find high resolution speleothems (speleothems which allow us to distinguish closely spaced events) that are the right age. First we test a number of stalagmites, by drilling thin cores from the base and top of the column. These cores are then dated in the laboratory, which tells us the growth rate of the stalagmite and therefore the average temporal resolution of the climate record that it contains. Based on this information, we can go back to the cave to collect the speleothems that are most suitable for our research. The dates from our cores also give us important information about the history of the cave. For example, were there periods when the whole cave was so dry that no speleothems formed?



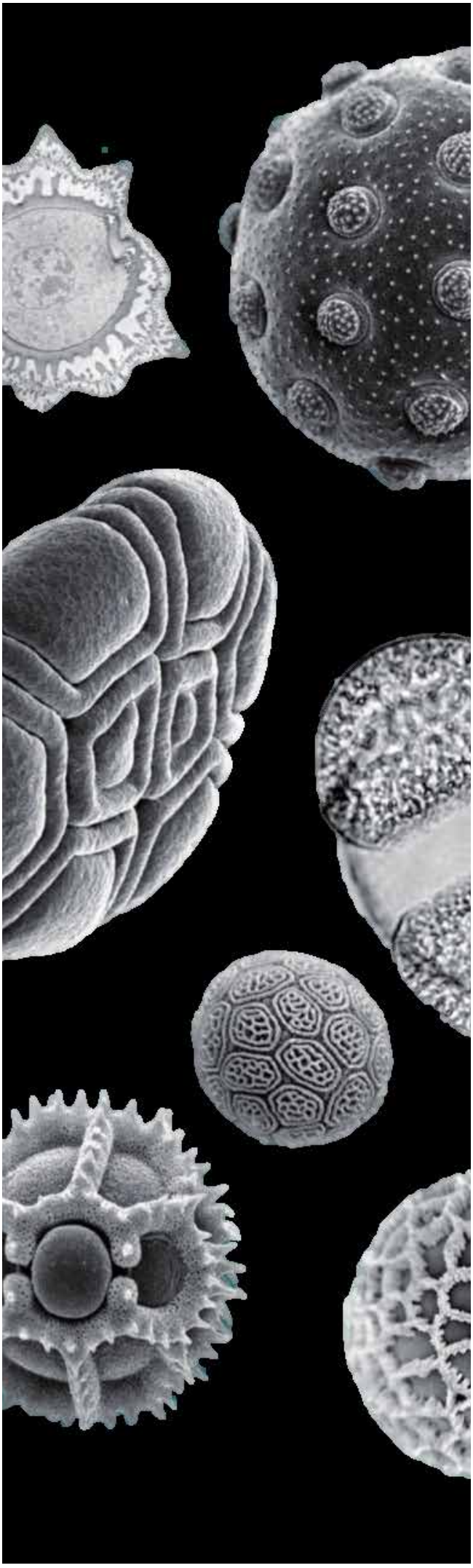


Photo from 'Pollen terminology, an illustrated book, Hesse et al. (2009)'

USING POLLEN TO RECONSTRUCT THE ENVIRONMENT DURING THE MIDDLE STONE AGE

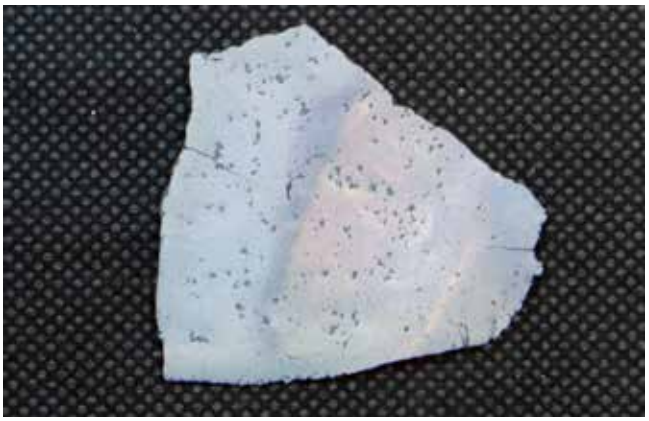
Many of the Middle Stone Age sites on the southern coast of South Africa have a diverse and unique flora. The relative composition of the vegetation types belonging to this flora largely depends on rainfall seasonality. Hence, past changes in the extent and seasonality of rainfall have significantly altered the vegetation in the region. Reconstructing vegetation shifts on the coastal plains of South Africa will help to unravel one of the main questions in SapienCE: How did climate and environment affect the behavioural evolution and development of early humans during the Middle Stone Age?

SapienCE PhD candidate Evi Naudts used pollen preserved in marine sediments to reconstruct past changes in vegetation in South African. Due to the scarcity of lakes and swamps, terrestrial records in southern Africa are often both discontinuous and have a low temporal resolution. In contrast, pollen preserved in marine sediments often provide continuous records of vegetation changes on land. For this project, she used marine records, with a high temporal resolution, from offshore of the Western and Eastern Capes. This allows an interregional comparison of environmental changes over the past 100 000 years.

Preliminary data derived from a marine core close to the Eastern Cape show significant changes in vegetation between 73 000 to 70 000 years ago when compared to 50 000 to 48 000 years ago. Increased abundance of Southern Afrotemperate Forest pollen during the earlier period indicates that wetter conditions prevailed at this time. Moreover, pollen data also suggest that vegetation changes occurred on much shorter timescales. Brief but substantial climatic changes, known as stadials (colder) and interstadials (warmer) in the Northern Hemisphere, can be linked to sudden shifts in our pollen record from the Southern Hemisphere. Comparison of these pollen data with the archaeological record will help us to understand how past environments affected early humans living on the coastal plains of South Africa during the Middle Stone Age.

Silje Evjenth Bentsen taking samples of experimental fires in 2015

Experimental heating of quartzite collected from Klasies River



Example of a heated ostrich eggshell fragment

EXPERIMENTAL ARCHAEOLOGY

Ostrich eggshell fragments give off a disgusting metallic stench when heated. Hot rocks produce crackling sounds while cooling down. The sand under a fire can stay above 100 °C even 10-12 hours after the fire went out. How do I know these things? I discovered them first-hand through experimental archaeology. Experimental archaeology is a term which describes practical experiments used to test an archaeological theory or understand an object. Quite often researchers need to perform a lot of experiments, redesigning the research at each stage, to achieve the desired result. One example of this process is a study of enigmatic fractured and reddened rocks from Klasies River, published by SapienCE post-doc Silje Evjenth Bentsen and Professor Sarah Wurz in 2019.

The experimental work started in 2015 during a University of the Witwatersrand excavation at Klasies River, a Middle Stone Age site in the Eastern Cape Province, South Africa. The excavation team knew that Klasies contained numerous small patches of ash from ancient fires, and we wanted to understand how warm these fires were and how long they burned for. This information could help us understand what the fires could be used for and how people used the site. Using locally collected wood, we created a number of small experimental fires, and discovered that while they produced enough heat to cook food they could only be used for a few hours. However, neither the temperature nor duration of these fires was sufficient to explain reddened and fractured quartzite rocks that we had recently excavated in Klasies River.

"Why are red and fractured quartzite rocks important?" you might ask. We know that some rocks become reddened and fracture when exposed to heat from a fire, so the quartzite excavated from Klasies River might provide us with clues about how fire was used at the site. However, in 2015 we did not know how the quartzite rock found around Klasies River reacted to heat, and even if it did redden and fracture,

we didn't know whether this heating was intentional or unintentional. There are many examples of intentional heating of rocks in the archaeological record, such as hot rocks used to heat water or rocks used as hearth-stones to contain a fire. However, hot-rock cooking and hearth-stones are known from sites that are much younger than Klasies River. Unintentional heating of rocks can happen if the rock was buried in sediments under a fire, but only if they are close to the fire and the temperature is high. We needed to know whether, and how, the reddened quartzite blocks were heated.

Our first experiment was to collect quartzite cobblestones from the beach in front of Klasies, and heat 26 of them in small fires. Some of the heated samples changed colour, though not to the same shade of red seen in the archaeological sample, and very few fractured. Reheating the samples in new fires produced the same result. Were the experimental fires too small to affect the quartzite, or does local quartzite not change colour when heated? We repeated the experiment with larger fires, and this time the samples changed colour and fractured. Next, we dropped some heated quartzite cobbles into water, as if to heat the water, while other rocks were allowed to cool slowly in the air. The colour and fracturing of the air-cooled cobbles was most similar to the archaeological samples, which suggests that the Klasies inhabitants did not practice hot-rock boiling.

But one question remained: How can we best quantify colour so that we can compare the results from different experiments? We discovered a method, mostly used in food science, where high resolution digital photographs are analysed in image processing software, yielding numerical colour values. Using this method, we quantified the colour change through three heating cycles, and demonstrated that it was possible to distinguish between unheated samples and the same samples after they had been heated three times. The colour values of rocks experimentally heated 2-3 times were most similar to the archaeological samples.

So what about the appalling smell of burning ostrich eggshell? I moved to SapienCE in 2018 and started a study on heating of ostrich eggshell, which is found in many Middle Stone Age sites. Colours and other changes are important to understand how the eggs were heated, and whether heating was intentional. I have conducted a number of laboratory heating experiments on Norwegian and South African eggshells to measure how colour changes at specific temperatures. This hasn't made me any friends in nearby offices! In February 2020 I will lead the first SapienCE experimental field season, working with colleagues to understand the effects of burning on eggshells, small mammal bones, sediments and shellfish. We will also be experimenting with new methods of documenting and recording these effects. We will bring news from the (hopefully not too smelly) season next year!

The experimental setup before the fire experiments at Klasies River in 2015

The effects of experimental heating of quartzite from Klasies River

Laboratory setup before heating ostrich eggshells in a laboratory furnace

INTO THE CAVE

The archaeologists who found the world's oldest human-made drawing are back in Blombos Cave in search of new discoveries. Professor Henshilwood welcomes us to the cave to show us his team at work as they dig for clues that can tell us how early humans lived.

The trip to the cave is challenging if you are not accustomed to off-road driving. After the vehicles have been parked, we walk down a steep path cut into the hillside and arrive at Blombos Cave. The group consists of researchers from the University of Bergen (UiB), Germany, England and also UiB's Rector, Dag Rune Olsen.

Layer upon layer of stories

The interdisciplinary research team is well underway with this year's dig. They look pleased, and maybe somewhat secretive.

Archaeologists often know when they have found something special, but many years may pass before they can fully explain the importance of the find. Specialised analyses and laboratory testing are necessary before they can explain, for example, how an object was used or how old it is.

The excavations have cut down through the cave sediment, revealing numerous different coloured archaeological layers.

"Each of the archaeological layers tells a story about the people who have lived here," explains Henshilwood.

He takes us back in time — to the time when our ancestors lived here in this cave. Henshilwood describes various items that that have been discovered here, and explains how each of them tell us something about how our ancestors began to use symbols to communicate with

each other, much like people do today. In addition to the world's oldest drawing, researchers have found engraved ochre stones, seashell necklaces and tools made from bone and stone in Blombos Cave. Several of the discoveries have been published in prestigious journals such as Nature and Science.

Well preserved finds

"What is fascinating about this cave is that everything we find is very well preserved. People lived in this cave between about 100,000 and 70,000 years ago, but then sand filled the valley in front of the cave. It also filled the cave entrance and settled as a protective layer over everything that was buried here. The cave mouth remained blocked until about 2000 years ago, when the landscape had changed and made the cave opening visible again", he explains.

It was Henshilwood himself who discovered the cave, which is located on the family's property.

"My grandfather had a holiday home at Blombos, and I used to spend all my summer holidays here. I remember we used to find a lot of exciting objects on the beach, like shells and other things", recalls Henshilwood and adds:
"Now we know that many of the things that we find are stone tools and other artefacts created by the people who lived here".

Natural protection

Henshilwood and the other researchers believe that early humans lived in the cave for short periods of time, rather than inhabiting it permanently. The clearly defined cultural layers combined with the analysis of the sediment in each layer show that they do not belong to the same era, nor have they been mixed together by plant roots or burrowing animals as is often the case. Because of this, the cave must be excavated layer by layer so that we know which objects are the same age and belong together.

"We have to dig very carefully because the relationship between objects in a single layer tell a story about how people used the cave. Several of the layers we have uncovered have contained important information about the people who lived here. We find everything from food to art and tools that have been used. Using specialised analyses, we can find out what these people ate and how they have prepared the food, or we can try to understand how tools were made and what they were used for.

The SapienCE drone

The researchers at SapienCE use advanced technology for reconstructing the past. Recently they acquired their own drone. PhD student Ole Fredrik Unhammer flies the drone and takes photos that he uses to create a 3D model of the landscape surrounding the cave.

"The aim is to reconstruct the landscape in order to be able to say something more about how it may have looked in the past," says Unhammer. The reconstruction of the landscape may help the team to understand the environment in which the Blombos inhabitants lived and the type of vegetation that might have been here. Unhammer also hopes that the drone can help the team discover new caves to excavate.

Who we are – deep down

Rector Dag Rune Olsen is impressed by the way in which the researchers at SapienCE work.

"This is a brilliant example of world-class research! I am very proud of this interdisciplinary team which produces research of such a high international standard. I must also add that it is amazing to have the opportunity to learn more about how human behaviour has evolved, and how this can be seen through ancient symbolic and artistic expression. These are questions that concern us all, and that may be able to say something fundamental about what it means to be human.

OUTREACH

STILL BAY TALKS – MEETING THE LOCALS

During the excavations at Blombos Cave in February 2019, SapienCE researchers were invited by Hessequa Society of Archaeology to give a public lecture at Still Bay Town Hall. Christopher Henshilwood began the evening by introducing our ongoing work at Blombos Cave, after which doctoral candidates, post-docs and senior researchers gave summaries of their specialized areas of research. Lastly, Craig Foster elegantly tied all our research into a broader human perspective. We had anticipated an attendance of maybe 50 eager members of the archaeological society, but were very happily surprised to fill all 500 seats in the hall! For the SapienCE researchers involved, it was a wonderful experience to see the public's interest in our work, and to understand the pride and sense of identity that Blombos Cave gives to the local community.

SAPIENCE LUNCHTIME SEMINARS

The SapienCE Lunchtime Seminars are informal research presentations held at lunchtime in the main SapienCE meeting room. A total of 15 seminars have been given since the series started in March 2019. The lunchtime seminars provide an arena in which members of the SapienCE centre, visiting researchers and students, can present their results. The seminars have an informal atmosphere and are intended to allow speakers to discuss their work with the full SapienCE team, thereby ensuring that different research groups are aware of each other's work.

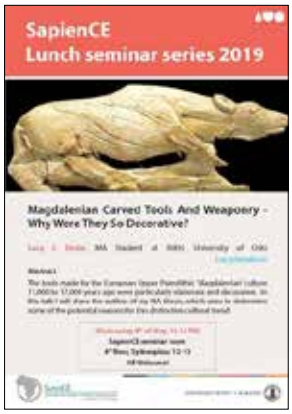
Environment and climate

This year we have had several talks about palaeo-environments and climate. The climate modelling team presented two talks on the process of downscaling global climate models and the challenges that this posed. Nonetheless, this work is critical if we are to test potential links between the evolution of human behaviour and past climate. The analysis of climate and environment proxies was another recurring theme, with interesting talks on the use of microfossils, shellfish and pollen from marine sediment cores. These talks demonstrated the variety of independent sources that are being explored in order to understand the climate and landscape that our ancestors lived in.

Cognition/ human behaviour

Understanding the behaviour of early humans is a key SapienCE research topic, and a number of visiting researchers addressed this question in their seminars. We were treated to interesting talks on ornate tools and weaponry from the Magdalenian period, how the identification of ancient bird remains can improve our understanding of Neanderthal lifeways and new theories on the cognitive implications of Palaeolithic stone tools. In addition, a presentation on the mobility and environmental management practices of present-day Kua hunter-gatherers challenged us to rethink our assumptions about ancient human populations.

SapienCE is a multidisciplinary centre, with members and research teams spread out across different faculties in Bergen. The lunchtime seminars have become an enjoyable social event and have proven to be a productive way to cultivate discussions between the numerous different disciplines represented within SapienCE.



1	Ole Fredrik Unhammer	The recording at Blombos Cave 2019.	SapienCE
2	Jenny Maccali	U-Th dating of south African speleothems.	SapienCE
3	Magnus Haaland	Report in recent investigations in Pomongwe Cave- a middle stone age site in Zimbabwe.	SapienCE
4	Silje Bentsen	Colour me heated? A comparison of potential methods to quantify colour change in thermally altered rocks.	SapienCE
5	Lucy Emke	Magdalenian carved tools and weaponry. Why where they so decorative?	Visiting Student
6	Evi Naudts	First impressions of southern African pollen analysis of marine sediment cores.	SapienCE
7	Margit Simon	Following the rivers- fieldwork in eastern and southern Africa 2018.	SapienCE
8	Karenleigh Overmann	A new look at the cognitive implications of Palaeolithic stone tools.	Associate
9	Inez Faul	MIS 5c-d at Klasies River: an analysis of microfossils to infer palaeoenvironmental conditions.	Visiting Student
10	Stefan Sobolowski	Climate Modelling at SapienCE – an update from the trenches.	SapienCE
11	Helga Vierich	A discussion on the hunter gatherer mobility and environmental management.	Visiting
12	Ozan Mert Göktürk	Modelling the paleoclimate of southern Africa: The method and the challenges.	SapienCE
13	Jovana Milic	Reconstruction of paleotemperatures in the southern African Middle Stone Age using shellfish as proxies.	SapienCE
14	Linda Amos	A bird's Eye view of the Middle Palaeolithic	Visiting Student
15	Silje Bentsen	Cast it into the Fire!	SapienCE

SELECTED SAPIENCE PUBLIC OUTREACH EVENTS 2019

A DAY IN THE LIFE: HOMO SAPIENS 100 000 YEARS AGO

What was life like for early modern humans in Africa 50 000- 100 000 years ago? When and how did early humans start to think and behave the way we do? How did climate and environmental changes contribute to this development? These issues are at the heart of our research and they are also the questions we often receive from the public. In September 2019, SapienCE organized a public panel discussion at the Bergen Library to address these questions. Visiting researcher Helga Vierich joined SapienCE researchers Francesco d'Errico and Simon Armitage on the panel, and the discussion was led by post-doc Silje Evjenth Bentsen. The event was very popular; indeed, there was not enough space for everyone who wanted to attend. The panel members gave inspiring introductions to their field and had a lively debate, before opening the floor for questions. The next 30 minutes were filled with interesting and thought-provoking questions from the audience and responses by the panel members. Look out for similar SapienCE events in 2020.

CHRISTOPHER HENSHILWOOD GAVE THE 2019 DARWIN LECTURE

Every year the University of Bergen celebrates Darwin day, the 12th of February, with a lecture by a distinguished scholar. Christopher Henshilwood gave the 2019 lecture on early modern human behaviour and the work of the SapienCE Centre of Excellence. His talk, entitled "Mother Africa – Welcome home: The behavioural origins of *Homo sapiens* in southern Africa between 120,000-50,000 years ago" filled the Egget lecture theatre with students, professors and the general public.

OCEANS AND HUMANS

World-renowned filmmaker, advocate for marine conservation and explorer of early human origins, Craig Foster, visited Bergen in October. Craig has a longstanding association with SapienCE, having co-curated the 'Origins of Early Sapiens Behaviour' exhibition and produced numerous stunning images for our scientific publications and public outreach events. Craig gave a presentation in which he described his encounters with marine life on the southern coast of South Africa, and discussed his passion for the ocean with Christopher Henshilwood and Jarl Giske from the Department of Biological Sciences. His talk, entitled "A 100 000 year aquatic journey with our southern African ancestors" was held at Media City Bergen, and attracted a large audience.

TEGNETRIENNALEN 2019

In 2019, the Norwegian Drawing Triennial, Tegnetriennalen, was held at Kunstnernes Hus in Oslo. Kunstnernes Hus is an independent institution dedicated to contemporary art, and a major venue for art and culture events. Blombos Cave and the world's earliest drawing were among the inspirations for Tegnetriennalen 2019. The curator invited SapienCE post-docs, Turid Hillestad Nel and Silje Evjenth Bentsen to give a lunch seminar in December. They gave the audience an insight into Blombos Cave, prehistoric symbols and early modern humans. Members of the audience clearly enjoyed the opportunity to engage with our researchers, and most asked questions or talked to them after the event. "It was great to have such an active audience" Turid and Silje commented on returning to Bergen.

POPVITEN PODCAST: THE FIRST HUMANS

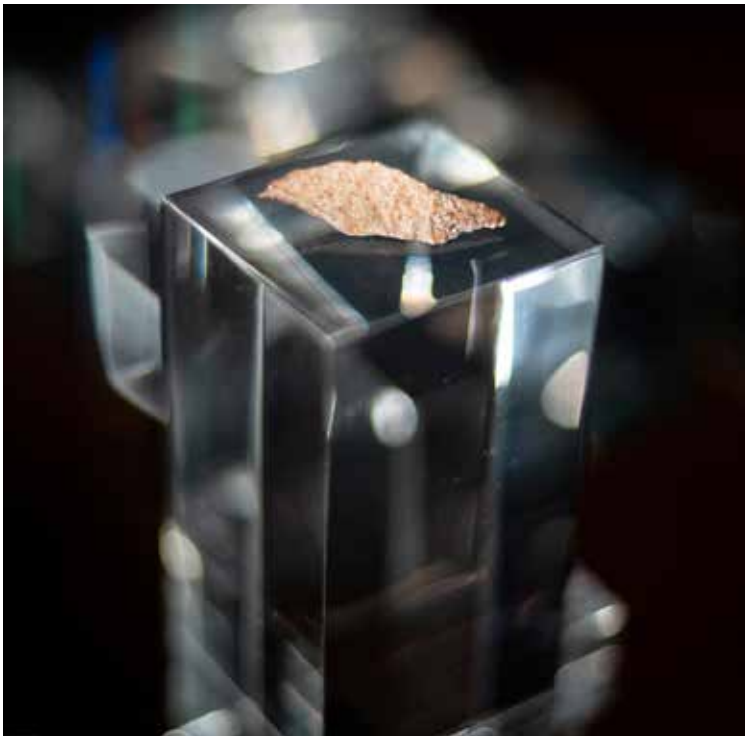
SapienCE researchers are often invited to participate in new outreach formats. In 2019 post-doc Magnus Haaland was invited to participate in Popviten, the University of Bergen podcast. Popviten is a podcast series produced by the university's communication department, in which each 20-minute episode is dedicated to an interview with an individual researcher. Magnus provided his own perspectives on archaeology, Blombos and the earliest modern humans in his interview, and so far the episode has been downloaded 1278 times.

BLOMBOS CAVE INTERVIEW AT THE JOHN MAYTHAM SHOW

The Cape Talk radio programme Afternoon Drive with John Maytham is a popular Cape Town show known for its difficult interviews with politicians and in-depth conversations with authors and entertainers. Host John Maytham interviewed Christopher Henshilwood in 2019 to discuss Blombos, SapienCE and early modern humans. Listeners were given an overview of SapienCE research and introduced to all the important finds from Blombos Cave.

ORIGINS OF EARLY SAPIENS BEHAVIOUR EXHIBITION AT IZIKO SOUTH AFRICAN MUSEUM

In April 2019 the Iziko South African Museum in Cape Town launched the 'Origins of Early Sapiens Behaviour' exhibition. The exhibition displays some 30 years of archaeological research in the southern Cape, highlighting key discoveries made at Blombos Cave, Klipdrift Shelter and Klasies River by Christopher Henshilwood, Karen van Niekerk, Sarah Wurz and their research teams. Short videos, information panels and displays of key archaeological finds are complemented by a bone collage that dominates one end of the exhibition space, and acts as a projection screen for films and images. The attention to detail and stunning visual effects are hallmarks of the exhibition's curators Craig Foster and Petro Keene. The exhibition, which is a collaboration between SapienCE and the University of the Witwatersrand SARChI Chair in Modern Human Behaviour, will be on display in Cape Town until January 2021. After 2021, versions of the exhibition will be displayed at the University of Bergen Museum, and in a purpose-built museum in the Western Cape town of Still Bay, close to Blombos Cave. The exhibition has already attracted many local groups and international tourists. Our only regret is that it represents the culmination of Petro Keene's association with our team. We wish you a long and happy retirement Petro.



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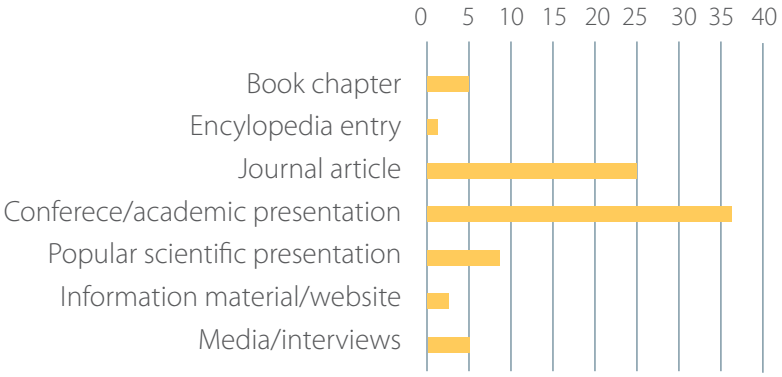
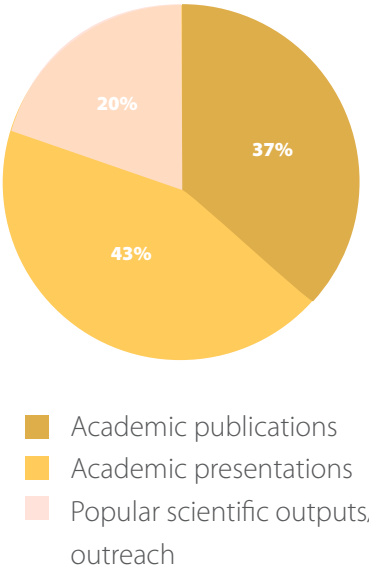
SAPIENCE OUTPUTS 2019



SCIENTIFIC AND POPULAR OUTPUTS



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Christopher Stuart Henshilwood
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Director, PI

Francesco d'Errico
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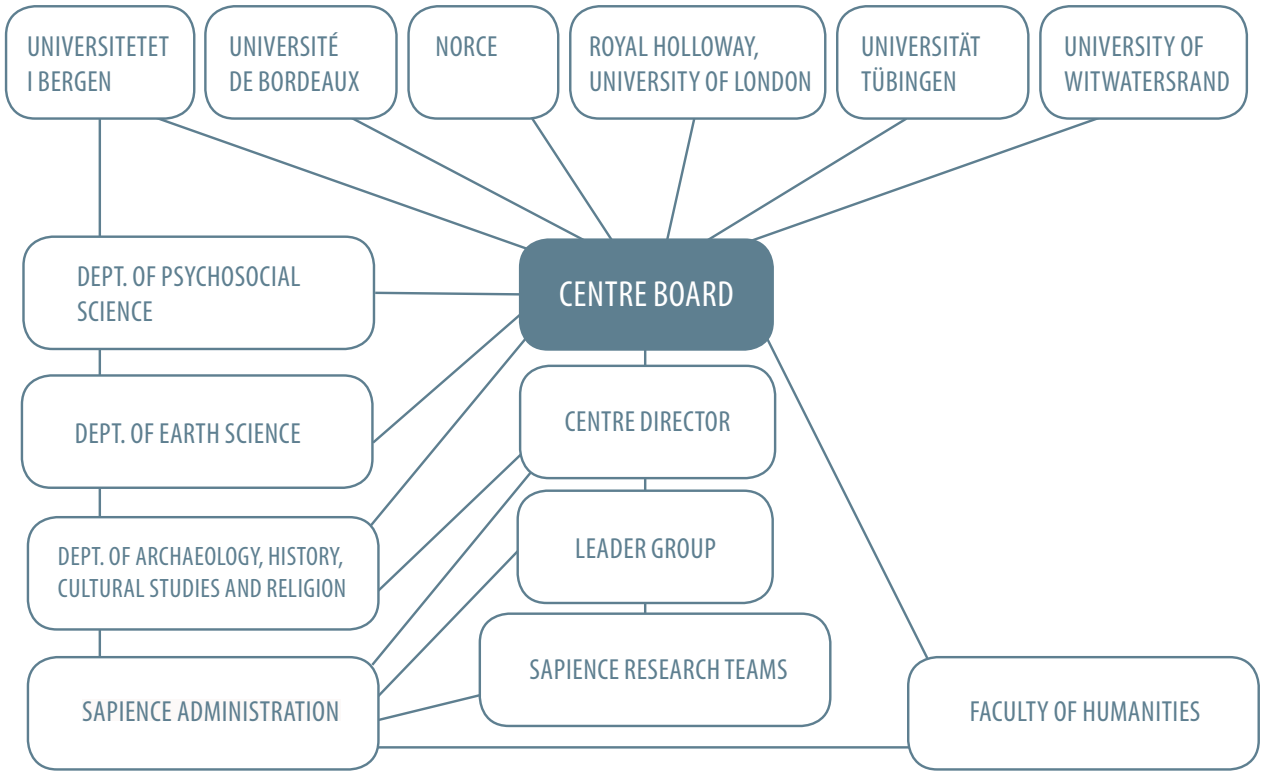
Sarah Wurz
Professor
Senior scientist

CENTRE STRUCTURE



SAPIENCE BOARD

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Secretary without voting rights		
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NEW MEMBERS

We are happy to welcome Professor Asifa Majid and Professor Ralph Schneider to the SapienCE Scientific Advisory Committee in 2019.

Majid is a leading expert on the influences of language and culture on cognition. Having earned her PhD in psychology at the University of Glasgow, she moved to the Netherlands in 2001 as a Marie Curie Fellow, and later became a Senior Investigator at the Max Planck Institute for Psycholinguistics in Nijmegen, as well as Affiliated Principal Investigator at the Donders Institute for Brain, Cognition and Behaviour at Radboud University. Equipped with an NWO VICI grant (of €1.5 million) to study olfactory language and cognition across diverse cultures, she became a Professor at the Center for Language Studies at Radboud University. In 2018, she moved to the University of York to become a Distinguished Professor in the Department of Psychology. In recognition of her sustained outstanding contributions to psychology and linguistics, she was elected Fellow of the Association for Psychological Science and of The Academy of Europe (Linguistics Section), and she is the present chair of the Cognitive Science Society. With her unique expertise, Majid will reinforce the Centre's activities focused on cognition and symbolic behaviour.

Schneider is a leading expert on paleoclimate and has worked extensively on past land-ocean interactions in Africa. After receiving his doctorate at the University of Bremen, he worked as a research assistant in marine geology and paleoclimate research at the Centre for Marine Environmental Sciences (MARUM) in Bremen. In 2003 he was appointed as a Professor in Palaeoceanography at Bordeaux University, France and moved to Kiel in 2005 were he was appointed as a Professor in Marine Geology and Paleoclimate Research. Since 2009, he is also Scientific Director of the Leibniz Laboratory for Radiocarbon Dating and Isotope Research. Schneider has held central positions in international research programmes and in the leadership of Centres of Excellence at Kiel University. Schneider's appointment to the Scientific Advisory Committee will help guide the climate activities of the Centre.

PIs AND RESEARCHERS AT SAPIENCE

Christopher Stuart Henshilwood	PI, Professor, SapienCE Director DST/NRF SARChI Chair in Modern Human Behaviour	Department of Archaeology, History, Cultural Studies and Religion, University of Bergen Evolutionary Studies Institute University of the Witwatersrand Johannesburg, South Africa
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Andrea Bender	PI, Professor	Department of Psychosocial Science, University of Bergen
Simon Armitage	PI, Professor	Department of Geography and Centre for Quaternary Research, Royal Holloway University of London
Carin Andersson Dahl	PI, Research Professor	NORCE Climate
Francesco d'Errico	Directeur de recherche de classe exceptionnelle Professor II	CNRS Université de Bordeaux Department of Archaeology, History, Cultural Studies and Religion, University of Bergen
Christopher Miller	Professor Professor II	Geoarchäologie, Institut für Naturwissenschaftliche Archäologie, Unversität Tübingen. Department of Archaeology, History, Cultural Studies and Religion, University of Bergen
Sarah Wurz	Professor Professor II	School of Geography, Archaeology and Environmental Studies, University of Witwatersrand Department of Archaeology, History, Cultural Studies and Religion, University of Bergen
Kenneth Hugdahl	Professor	Department of Biological and Medical Psychology, University of Bergen

Torill Christine Lindstrøm	Professor	Department of Psychosocial Science, University of Bergen
Stein-Erik Lauritzen	Professor	Department of Earth Science, University of Bergen
Anna Nele Meckler	Associate professor	Department of Earth Science, University of Bergen
Margit Simon	Researcher	NORCE Climate
Zhongshi Zhang	Researcher	NORCE Climate
Odd Helge Otterå	Researcher	NORCE Climate
Stefan Pieter Sobolowski	Research Professor	NORCE Climate
SapienCE Postdoctoral Research Fellows 2019		
Turid Hillestad Nel		Department of Archaeology, History, Cultural Studies and Religion, University of Bergen
Magnus Mathisen Haaland		Department of Archaeology, History, Cultural Studies and Religion, University of Bergen
Jenny Maccali		Department of Earth Science, University of Bergen
Silje Evjenth Bentsen		Department of Archaeology, History, Cultural Studies and Religion, University of Bergen
Ozan Mert Göktürk		Department of Earth Science, University of Bergen
Elizabeth Velliky		Department of Archaeology, History, Cultural Studies and Religion, University of Bergen
Larissa Mendoza Straffon		Department of Psychosocial Science, University of Bergen
Doctoral Fellows (Ph.D. candidates) 2019		
Ole Fredrik Unhammer		Department of Archaeology, History, Cultural Studies and Religion, University of Bergen
Evi Linda Naudts		Department of Earth Science, University of Bergen
Jovana Milic		Department of Archaeology, History, Cultural Studies and Religion, University of Bergen

SAPIENCE ADMINISTRATION 2019

The organisation, management and administration of SapienCE is regulated through the "Guidelines for Centre of Excellence (SFF-IV) at the University of Bergen". The guidelines are based on the requirements and guidelines of the Research Council of Norway, and were adopted by the University Board 24 August 2017.

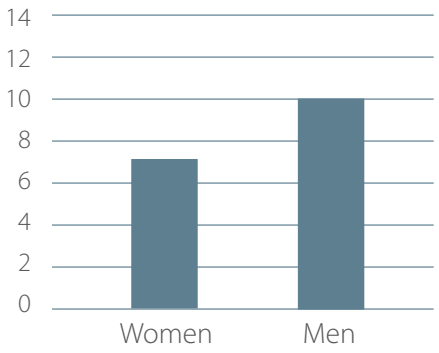
The guidelines state that SapienCE is led by a centre director responsible for all activity at the centre and who reports to the board. The centre has a leader group consisting of the centre director, vice director and research directors (PIs). The leader group shall participate in the preparations of the items to be discussed by the board. In addition, SapienCE has a scientific advisory committee to support the centre by providing input on the centre's scientific strategy and challenges throughout the project period. The centre has an administrative leader who shall assist the centre director in the day-to-day operations of the centre, serve as secretary to the leader group and be the liaison to other administrative personnel and partners. Additional administrative resources shall possess expertise to meet the needs of the centre; infrastructure, finance, HR, research administration and advisory services, administration of doctoral education, information dissemination and communication. The administrative resources are partly funded by the Research Council of Norway and partly by the University of Bergen.

The resources are organised so that the centre's administration, beyond the position of administrative leader, shall be an integral part of the ordinary administration. This ensures administrative expertise at the department and faculty levels, and ordinary guidelines and procedures are followed as in the regular units. Thus, administrative support is provided for their respective employees by all the SapienCE partners, which either contribute with in-kind funding or receives dedicated grants from the Centre. The employer's liability follows the employment, and the local administrations are responsible for HR related and ordinary financial matters.

Personnel involved in the SapienCE administration in 2019	
Ståle Berglund	Administrative leader
Turid Hillestad Nel	Temporary administrative leader (from December 2019)
Janne-Beate Buanes Duke	Adviser, Media and communication
Mari Knudsen	Adviser, Economy and accounting
Vibeke Wallacher Enæs	Executive officer, Front desk
Torunn Saunes	Senior Executive officer, Doctoral education coordinator
Anna- Lisa Aarefjord	Senior Executive Officer, HR
Eirik Kvam Goksøy	Senior Executive Officer, Web support
Faculty of Humanities	
Asbjørn Sæther	Senior Executive Officer, HR
Kirsten Moen	Senior Adviser, Research
SapienCE administrators, curation and field support in Cape Town, South Africa	
Petro Keene	Curator/Collections manager Evolutionary Studies Institute, University of the Witwatersrand
Samantha Mienies	Curator/Collections Manager (from June) Evolutionary Studies Institute, University of the Witwatersrand
Lisa Hulett	Administrator Evolutionary Studies Institute, University of the Witwatersrand

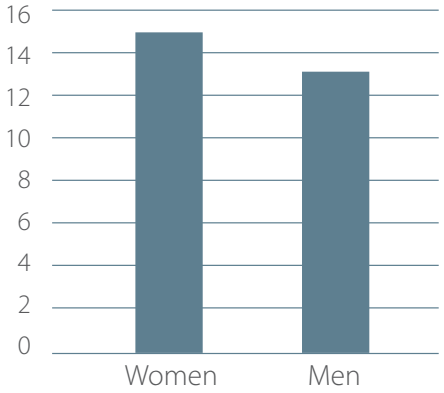
DISTRIBUTION OF GENDER IN SCIENTIFIC POSITIONS AT SAPIENCE

Senior scientific positions				
	Number of	% number of	FTEs*	% FTEs*
Women	7	41	2,7	41
Men	10	59	3,9	59
Total	17	100	6,6	100



All scientific positions (including doctoral and postdoctoral fellows)				
	Number of	% number of	FTEs*	% FTEs*
Women	14	52	7,7	53,8
Men	13	48	6,6	46,2
Total	27	100	14,3	100

* Full time equivalents



SAPIENCE FUNDING IN 2017-2019

In 2019, the principal sources of funding for SapienCE were the RCN and own-financing from the host institution, in addition to a substantial level of in-kind contributions. SapienCE obtained additional funding from national and international sources. These funds in particular allowed for a higher activity level and broader scope, predominantly within the archaeological research conducted by SapienCE. An overview of SapienCE funds for 2017-2019 is given below.

SapienCE Funds 2018-2019 (NOK)			
Source	**2017**	**2018**	**2019**
Own financing (Host Institution)	1 630 360	7 640 249	9 450 603
Agreed in kind plus additional estimated in kind (Partner Institutions)	248 200	1 275 125	1 109 108
RCN contribution	0	11 725 500	9 607 047
Additional project funds (University of the Witwatersrand, South Africa; HUMEVAL, Norway	0	2 880 557	3 316 557
TOTAL FUNDING OF CENTRE ACTIVITY	**1 878 560**	**23 656 431**	**23 483 315**

SOCIAL MEDIA

Join us on Twitter! Be the first to receive interesting news and information about SapienCE events in Norway and South Africa. Our Tweets were viewed more than 18 000 times in 2019. The most popular tweet of 2019 announced the opening of our 'Origins of Early Sapiens Behaviour' exhibition at Iziko South African Museum in Cape Town, closely followed by a tweet announcing a new paper on early human engravings co-authored by Francesco d'Errico. Scan the QR code to stay up to date.

Of course, we have a Facebook page! We post news, events and papers here, but there are big differences between the interests of our Twitter and Facebook followers. Our most popular Facebook post, which reached nearly 13 500 people, showed the University of Bergen Rector Dag Rune Olsen, visiting our excavation at Blombos. Our second most popular post reached 3 300 people, and highlighted a newspaper article commemorating shell beads found at Blombos in 2004. Scan the QR code and reflect on the fact that, like our SapienCE archaeologists, you're interested in yesterday's cutting-edge technology

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