Annual Report of the Research Center for 2018

The Role of Culture in Early Expansions of Humans (Frankfurt and Tübingen)

Human evolution is a story of expansions. During the last two million years the genus *Homo* spread from Africa into Asia and Europe in several waves of migration. New species developed and old groups became extinct (*range expansions*). As early as three million years ago, hominins had established new ways of dealing with their specific environment through culture. Stone tools produced with the help of another stone tool opened up access to new resources and activated changes in body, mind and behavior (*expansion of performances*). The ecospace of human species and their conspecifics changed the viability and development of potential resource spaces not only through natural processes, but also through changes in the distribution of a species and its behavior, which itself was increasingly shaped by culture (*expansions of resource space*).

ROCEEH's mission is to develop a systemic understanding of "becoming human", one which integrates these three types of expansion and how they interacted with each other. The project encompasses the time from three million to 20,000 years before present and spans from Africa to Eurasia. The project focuses particular attention on the development of the human capacity for cultural activities, as well as its background and characteristics.

At the core of the project is the multidisciplinary, web-based georelational database known as ROAD (ROCEEH Out-of-Africa Database) with its geographical information system (GIS) functionality. ROAD unifies geographical data about sites with additional information about the stratigraphical structure of layers and the archaeology those layers contain. In addition, ROAD assimilates information on human fossil history, fauna, flora and climate, information which can be used to model early human habitats. The results are integrated into a digital atlas detailing the development of humans and environment on the basis of GIS.

Started in 2008 and projected to run for 20 years, ROCEEH is a multidisciplinary research project situated at the interface between the cultural and natural sciences. This far-reaching, international effort is carried out by a team of cultural scientists, archaeologists, paleoanthropologists, paleobiologists, geographers and database specialists situated at the Senckenberg Research Institute in Frankfurt and the University of Tübingen.

Members of the Scientific Commission: regular members of the Academy, Barbara Beßlich (Heidelberg), Hermann H. Hahn (chairman, Karlsruhe), Lothar Ledderose (Heidelberg), Irmgard Männlein-Robert (Tübingen), Joseph Maran (Heidelberg), Ekkehard Ramm (Stuttgart); as well as Prof. Dr. Ofer Bar-Yosef (Harvard), Prof. Dr. Zvi Ben-Avraham (Tel Aviv), Prof. Dr. Manfred Ehlers (Osnabrück), Prof. Dr. Jürgen Richter (Köln), Prof. Dr. Wulf Schiefenhövel (Andechs), Prof. Dr. Mark Stoneking (Leipzig).

Heads of the Research Center: Nicholas Conard (speaker, Tübingen), Prof. Dr. Volker Hochschild (Tübingen), Volker Mosbrugger (Frankfurt/M.), Prof. Dr. Friedemann Schrenk (Frankfurt/M.).

Research staff: in Frankfurt, Priv.-Doz. Dr. Angela Bruch (60%), Claudia Groth (parental leave starting December 2018), Priv.-Doz. Dr. Miriam Haidle (scientific coordinator, 60%), Dr. Christine Hertler, Dipl.-Biol. Julia Hess (administrative coordinator, 50%); in Tübingen, apl. Prof. Dr. Michael Bolus, Dipl.-Inf. Zara Kanaeva, Dr. Andrew Kandel, Maria Malina, Dr. habil. Michael Märker (through August 2018, 40%), Christian Sommer, M.Sc.

Guests of the Research Center in 2018: Rimtautas Dapschauskas M.A. (Heidelberg, Germany), Dr. Benjamin Davies (Auckland, New Zealand), Dr. Ivan Gabrielyan (Yerevan, Armenia), Prof. Dr. Anders Högberg (Kalmar, Sweden), Prof. Dr. Eliso Kvavadze (Tbilisi, Georgia), Prof. Dr. Marlize Lombard (Johannesburg, South Africa), Dr. Ariel Malinsky-Buller (Neuwied, Germany), Astghik Papikyan (Yerevan, Armenia), Prof. Dr. Martin Porr (Crawley, Australia) and Dr. Yossi Zaidner (Jerusalem, Israel). In addition, three Humboldt Fellows were based at ROCEEH/Tübingen in 2018: Prof. Dr. Robert Kelly (Laramie, USA), Dr. Feng Li (Beijing, China) and Dr. Aurore Val (Johannesburg, South Africa). Furthermore, Dr. Knut Bretzke is based at ROCEEH/Frankfurt within the framework of his DFG-funded project, and since October 2018 Priv.-Doz Dr. Oliver Schlaudt (Heidelberg, Germany) is based at ROCEEH/Tübingen as a Heisenberg Fellow of the DFG.

Key aspects

During its eleventh year, ROCEEH focused its research on two case studies which make use of differing methodologies. The first study was dedicated to exploring the significance of material culture. Within the framework of this study, ROCEEH examined how a single artifact can lead to the generation of a comprehensive model of cultural development. The

starting point was a fragment of an eyed needle discovered at Aghitu-3, one of ROCEEH's archaeological excavations in Armenia. ROCEEH examined the needle using its freshly minted "cultural concept" (see 2017 Yearbook of the Heidelberg Academy of Sciences and Humanities), which plays a key role in the Research Center's investigations of "becoming human." So far, eyed needles are known only from the Upper Paleolithic (about 40,000–25,000 years ago) of Asia and are found in contexts related to the presence of anatomically modern humans. The needle from Aghitu counts among the oldest in the world and represents the southwestern-most point of their extent which stretches eastward into Siberia, and northwards into the Arctic region. The distribution of needles corresponds to the number of days of frost observed today. Taken together, needle and thread are used in the production of complex clothing and represent one of many cultural solutions to the problem of how to stay warm. This adaptation enabled humans to spread into northerly latitudes as well as high altitude regions such as Armenia.

When eyed needles and thread are joined together, this set can be applied to complicated sewing tasks and represents a clear expression of advanced complementary cultural capacities (see 2011 Yearbook of the Heidelberg Academy of Sciences and Humanities). A multitude of activities relate to the production of complex clothing, in which different raw materials and tools are employed using various technologies. These activities require knowledge and practice which developed from dealing with different material elements. Keeping and transmitting the multifaceted knowledge and skills within the group required a degree of social engagement. As a result, other people and other social groups grew increasingly important in serving as resources of manpower, tradition, experience and organization. Based on these examples of broad contexts of activities and resources necessary for the production of clothing, individuals and groups established a developmental model of human resources. During the process of "becoming human," the increasingly tighter network of social connections and the increasingly multifaceted material engagement became so intertwined that cultural development can be understood as the progressive consolidation of social and material domains.

The second case study concerns itself with the material and resource cultures of Neanderthals as well as their land use patterns under different climatic conditions. As the basis for the study, ROCEEH selected 53 assemblages from 36 localities from a clear cold phase (Marine Isotope Stage (MIS) 6 from 191,000-130,000 years ago) und 55 assemblages from 34

localities from a clear warm phase (MIS 5e from 130,000-116,000 years ago). Only clearly stratified and well dated collections were selected for study, so this dataset represents the most reliable and complete dataset available for this time in Europe. On the basis of landscape reconstruction, the analysis of cultural materials, and modeling seasonal changes in the availability of herbivores and plants as food sources, three main questions were posed:

- Are there differences in the material culture and land use patterns of Neanderthals between cold and warm phases?
- Did the resource cultures vary with the changing environments?
- When the Mediterranean experienced Ice Age conditions, did it serve as a suitable refugium for Neanderthals with regard to resource availability?

As parameters of material culture, several categories were examined, for example, technological aspects and the degree of diversity or specialization of stone tool assemblages, use of fire, use of wood as a raw material for tools, and the appearance of artifacts with a possibly symbolic meaning. Seasonal differences of the availability of edible plants and plant parts and the portion of seasonally migratory herbivores among the various biomes were considered as a backdrop to different landscape factors. The most important preliminary finding of this study was that, despite the significant climatic difference between MIS 6 (cold) and MIS 5e (warm), the stone technology and the resource culture of the Neanderthals showed few differences. Instead, Neanderthals showed flexible and adaptive solutions to deal with seasonally variable resource availability. Contrary to the general expectations, the Mediterranean seems to have been an unsuitable refugium, especially during glacial winters, while the northern shrub tundra and mammoth steppe proved to be better alternatives.

Newsletters providing additional information on these and other topics can be accessed through ROCEEH's website (www.roceeh.net).

Field Work

In 2018 the staff of the Research Center conducted or participated in ten field projects:

Africa

- South Africa: Sibudu Cave and Umbeli Belli Rock Shelter. Excavation and analysis (Conard, N., Bader, G., Kairies, M., Schmid, V., 12 weeks)

- Tanzania: Mumba Cave. Excavation and analysis (Conard, N. J., Bader G., 4 weeks)
- Tanzania: Dar es Salaam, Arusha, Makuyuni. Survey with focus on paleoclimatic data (Hertler, C., Lüdecke, T., Thiemeyer, H., 2.5 weeks)

Arabia

- United Arab Emirates: Sampling for chronological, paleoenvironmental and DNA studies around Jebel Faya and its surrounding wadi systems (Bretzke, K., 2 weeks)

Western Asia

- Iran: Ghar-e-Boof. Excavation and analysis (Conard, N., Zeidi, M., 8 weeks)

Caucasus

- Armenia: Aghitu 3. Analysis of finds (Kandel, A.W., Jabbour, F., 1.5 weeks)
- Georgia: Khvarbeti. Sampling for macrobotanical and pollen remains to reconstruct Early Pleistocene environment (Bruch, A.A., 1 week)
- Georgia: Chachuna. Survey and sampling for pollen test studies at a Late Miocene hominoid site (Bruch, A.A., 1 week)

Europe

- Germany: Hohle Fels in Schelkingen and Lonetal. Excavation and analysis (Malina, M., Conard, N.J., 13 weeks)
- Germany: Schöningen. Excavation and analysis (Conard, N.J., Serangeli, J., 6 weeks)

ROCEEH Out-of-Africa Database (ROAD) and ROADWeb

In 2018 we completed the beta version of ROCEEH's "locality data sheets." The project began last year as a way to synthesize all information entered into ROAD about a given locality. Our goal is to create a catalog of sites and publish them in pdf format as part of ROCEEH's Virtual Atlas, which we plan to make freely available to the public. This catalog will make it easier for users to access information about sites that are important to human evolution in the range of three million to 20,000 years ago. Such a summary is particularly helpful because many of the original sources are difficult to find or published in foreign languages. This information lays the foundation for understanding the cultural development of humans over time; it also allows us to preserve and disseminate information which is vital to understanding the early cultural heritage of humanity. At the same time, the locality data sheet serves as a helpful mechanism to conduct quality control of data entry.

In 2018, the software of the ROAD server and other servers was updated. However, the update of PHP software (from PHP 5 to PHP 7) had a negative effect on most program applications written in PHP, with the result that CSV and geodata imports had to be reprogrammed. The reprogramming of the import specifications began in December 2018. As in previous years, the user friendliness of ROADWeb was improved, for example, the data entry masks. Additionally, different corrections for ROAD and ROAD web applications were performed.

To expand the numbers of users in the ROAD network, we organized two workshops aimed at introducing users to writing SQL queries in ROAD and using ROADWeb. One workshop took place as part of the Computer Applications in Archaeology meeting held in Tübingen on 19 March, while the other occurred at the Indian Institute of Science, Education and Research in Chandigarh from 23-27 August.

Data entry continued in ROAD, so that as of 27 December, the database contained 1,764 localities with 8,265 assemblages.

Project relevant conference contributions and lectures by research staff

The staff of the Research Center participated in 14 conferences. They were the main organizers of three conferences (see Newsletter 14-2018 for conference reports): 1) Images, gestures, voices, lives. What can we learn from Palaeolithic art? in Tübingen; 2) 46th Annual International Conference on Computer Applications and Quantitative Methods in Archaeology, in Tübingen; and 3) Extended NECLIME Workshops in Sofia, Bulgaria. In addition, the ROCEEH staff led four workshops and nine conference sessions. They were lead or contributing authors in 30 lectures and presented two posters. They also presented the project or their work five times at work meetings, lecture series, and in the *Studium Generale*.

Third Party Funding

To complement the financing provided by the Academy, additional funds were sought for case studies, regional investigations and visits from guest researchers and young academics. ROCEEH received additional support from the German Ministry of Education and Research (BMBF), the International Union for Quaternary Research, the National Science Foundation of the USA, the Deutsche Forschungsgemeinschaft, and the Senckenberg Gesellschaft für Naturforschung. Three doctoral candidates received fellowships from the Gerda Henkel Foundation.

Teaching

In addition to their research activities, the staff strive to impart students with the benefits and results of their work and support graduate and postgraduate students in their qualifications:

- Lectures and seminars at the University of Frankfurt/Main: Angela Bruch, Christine Hertler
- Lectures and seminars at the University of Tübingen: Michael Bolus, Angela Bruch, Miriam Haidle, Andrew Kandel, Michael Märker
- Lectures and seminars at the Karlsruhe Institute of Technology: Christine Hertler
- Supervision of Master's, Diploma and Doctoral theses: Michael Bolus, Angela Bruch, Miriam Haidle, Christine Hertler, Andrew Kandel, Michael Märker
- Supervision of archaeotechnical trainees: Maria Malina

Project relevant publications by research staff and principal investigators

A total of 36 project relevant publications appeared in 2018 in which the principal investigators and staff of the Research Center played a leading or contributing role:

ISI-listed publications: 19

1. Bataille, G. & Conard, N.J. (2018): Blade and bladelet production at Hohle Fels Cave, AH IV in the Swabian Jura and its importance for characterizing the technological variability of the Aurignacian in Central Europe. PLoS ONE 13(4): e0194097.
2. Barbieri, A., Leven, C., Toffolo, M.B., Hodgins G.W.L., Kind, C.-J., Conard, N.J. & Miller, C.E. (2018): Bridging prehistoric caves with buried landscapes in the Swabian Jura (southwestern Germany). Quaternary International 485, 23-43. DOI: 10.1016/j.quaint.2017.08.002.
3. Bretzke, K., Yousif,E., Jasim, S. (2018): Filling in the gap – The Acheulean site Suhailah 1 from the central region of the Emirate of Sharjah, UAE. Quaternary International 466, 23-32.
4. Dutkiewicz, E., Wolf, S., Floss, H. & Conard, N.J. (2018): Les objets en ivoire du Jura souabe. L'Anthropologie 122, 447-468.
5. Dutkiewicz, E., Wolf, S. & Conard, N.J. (2018): Early symbolism in the Ach and the Lone valleys of southwestern Germany. Quaternary International 491, 30-45.
6. Falcucci, A., Peresani, M., Roussel, M., Normand, C. & Soressi, M. (2018): What's the point? Retouched bladelet variability in the Protoaurignacian. Results from Fumane, Isturitz, and Les Cottés. Archaeological and Anthropological Sciences 10, 539-554.

7. Giemsch, L., Hertler, C., Märker, M., Quénéhervé, G., Saanane, C. & Schrenk, F. (2018): Acheulean Sites at Makuyuni (Lake Manyara, Tanzania): Results of Archaeological Fieldwork and Classification of the Lithic Assemblages. African Archaeological Review, 1-20.
8. Kandel, A.W., Bretzke, B. & Conard, N.J. (2018): Epipaleolithic shell beads from Damascus Province, Syria. Quaternary International. 464 A, 126-140.
9. Lüdecke, T., Kullmer, O., Wacker, U., Sandrock, O., Fiebig, J., Schrenk, F. & Mulch, A. (2018): Dietary versatility of Early Pleistocene hominins. PNAS 115 (52), 13330-13335.
10. Märker, M. & Bolus, M. (2018): Explorative Spatial Analysis of Neandertal Sites using Terrain Analysis and Stochastic Environmental Modelling. GI_Forum 2018/2, 181-198.
11. Presnyakova, D.A., Braun, D.R., Conard, N.J., Feibel, C., Harris, J.W.K., Pop, C.M., Schlager, S. & Archer, W. (2018): Site fragmentation, hominin mobility and LCT variability reflected in the early Acheulean record of the Okote Member, at Koobi Fora, Kenya. Journal of Human Evolution 125, 195-180.
12. Reiche, I., Heckel, C., Müller, K., Jöris, O., Matthies, T., Conard, N.J., Floss H. & White, R. (2018): Kombinierte nicht-invasive PIXE/PIGE-Analysen von aurignacien-zeitlichen Objekten aus Mammutelfenbein bedeutender archäologischer Fundstätten. Angewandte Chemie 130, 7550–7554.
13. Rhodes, S.E., Ziegler, R., Starkovich, B.M. & Conard, N.J. (2018): Small mammal taxonomy, taphonomy, and the paleoenvironmental record during the Middle and Upper Paleolithic at Geißenklösterle Cave (Ach Valley, southwestern Germany). Quaternary Science Reviews 185, 199-221.
14. Serangeli, J., Rodríguez-Álvarez, B., Tucci, M., Verheijen, I., Bigga, G., Böhner, U., Urban, B., van Kolfschoten, T.& Conard, N.J. (2018). The Project Schöningen from an ecological and cultural perspective. Quaternary Science Reviews 198, 140-155.
15. Shimelmitz, R., Friesem, D., Clark, J.L., Groman-Yaroslavski, I., Weissbrod, L., Porat, N. & Kandel, A.W. (2018): Sefunim Cave. The Upper Paleolithic and Epipaleolithic of Sefunim Cave, Israel. Quaternary International 464 A, 106-125.
16. Smith, T.M., Houssaye, A., Kullmer, A., Le Cabec, A., Olejniczak, A.J., Schrenk, F., de Vos, J. & Tafforeau, P. (2018): Disentangling isolated dental remains of Asian Pleistocene hominins and pongines. PLoS ONE 13(11), e0204737.
17. Stolarczyk R.E. & Schmidt P. (2018): Is early silcrete heat treatment a new behavioural proxy in the Middle Stone Age? PLoS ONE 13(10), e0204705.

18. Wolf, S., Dapschauskas, R., Velliky, E., Floss, H., Kandel, A.W. &. Conard, N.J. (2018): The Use of Ochre and Painting During the Upper Paleolithic of the Swabian Jura in the Context of the Development of Ochre Use in Africa and Europe. Open Archaeology 2018/4, 185-205.
19. Zanolli, C., Pan, L., Dumoncel, J., Kullmer, O., Kundrat, M., Liu, W., Macchiarelli, R., Mancini, L., Schrenk, F., Tuniz, C. (2018): Inner tooth morphology of *Homo erectus* from Zhoukoudian. New evidence from an old collection housed at Uppsala University, Sweden. Journal of Human Evolution 116, 1-13.

Other peer reviewed publications: 11

1. Bachofer F., Quénéhervé G., Hertler C., Giemsch L., Hochschild V. & Maerker M. (2018) Paleoenvironmental Research in the Semiarid Lake Manyara Area, Northern Tanzania: A Synopsis. In: Siart C., Forbriger M., Bubenzer O. (eds) Digital Geoarchaeology. Natural Science in Archaeology. Cham: Springer, 123-138. DOI: 10.1007/978-3-319-25316-9_8
2. Bader, G.D., Tribolo, C. & Conard, N.J. (2018): A return to Umbeli Belli: New insights of recent excavations and implications for the final MSA of eastern South Africa. Journal of Archaeological Science: Reports 21, 733-757.
3. Conard, N.J. (2018): The age of ivory artifacts made from mammoth ivory from the Swabian Aurignacian. In: J.-J. Cleyet-Merle et al. (eds.), Mémoire de Mammouth. Les Eyzies: Musée national de Préhistoire, 13-16.
4. Falcucci, A. & Peresani, M. (2018): Protoaurignacian Core Reduction Procedures: Blade and Bladelet Technologies at Fumane Cave. Lithic Technology 43, 125-140.
5. Floss, H., Blumentritt, R., Hoyer, C., Huber, N., Velliky, E. & Conard, N.J. (2018): Palaeolithic cave art in the Swabian Jura? In: H. Floss & A. Pastoors (eds.), Palaeolithic rock and cave art in Central Europe? Rahden/Westf., Verlag Marie Leidorf, 107-122.
6. Garofoli, D. (2018): RECkoning with representational apriorism in evolutionary cognitive archaeology. Phenomenology and the Cognitive Sciences 17/5, 973–995.
7. Märker, M., Schillaci, C. & Kropáček, J. (2018): Morphometric terrain analysis to explore present day geohazards and paleolandscape forms and features in the surroundings of the Melka Kunture prehistoric site, Upper Awash Valley, Central Ethiopia. AUC Geographica 53(1), 10–19.
8. Ring, U., Albrecht, C. & Schrenk, F. (2018): The East African Rift System: Tectonics, Climate and Biodiversity. In: C. Hoorn, A. Perrigo & A. Antonelli (eds.), Mountains, climate and biodiversity. New York, John Wiley & Sons, 391-411.

9. Taller, A., Gasparyan, B. & Kandel, A.W. (2018): Living on the edge: The earliest modern human settlement of the Armenian Highlands in Aghitu-3 Cave. In: Nishiaki, Y. & Akazawa, T. (eds.), The Middle and Upper Paleolithic Archeology of the Levant and Beyond. Springer, Singapore 119-131.
10. Toniato, G., Münzel, S.C., Starkovich, B.M. & Conard, N.J. (2018): Middle and Upper Palaeolithic bone retouchers from the Swabian Jura: Raw materials, curation and use. In J.M. Hutson, A. García-Moreno, E.S. Noack, E. Turner, A. Villaluenga, S. Gaudzinski-Windheuser (eds.), The origins of bone tool technologies. Mainz: Verlag des Römisch-Germanischen Zentralmuseums, 251-267.
11. Will, M. & Conard, N.J. (2018): Assemblage variability and bifacial points in the lowermost Sibudan layers at Sibudu, South Africa. Archaeological and Anthropological Sciences 10, 389-414.

Publications without peer review: 3

1. Haidle, M.N. (2018): Schon in der Steinzeit... Über die ‚Natürlichkeit' menschlicher Geschlechterrollen aus urgeschichtlich-paläoanthropologischer Sicht. In: Bauer, Gero, Regina Ammicht Quinn & Ingrid Hotz-Davies (eds.), Die Naturalisierung des Geschlechts: Zur Beharrlichkeit der Zweigeschlechtlichkeit. Bielefeld: transcript, 15-30.
2. Maaß, C.-L., A.-L. Jerg, S. Lippe, F. Pfrommer, L.-A. Lazar, M. N. Haidle (2018). Images, gestures, voices, lives. What can we learn from Palaeolithic art? A conference at the University of Tübingen, organized by the Research Center "The Role of Culture in Early Expansions of Humans" (ROCEEH) and the Senckenberg Centre for Human Evolution and Palaeoenvironment (HEP). Mitteilungen der GfU 27.
3. Shatilova, I.I., Kvavadze, E.V., Kokolashvili, I.M. & Bruch, A.A. (2018): Atlas of Pollen of the Georgian upper Cenozoic – Gymnosperms and Angiosperms. Georgian National Museum, Tbilisi, Georgia.

Popular publications: 3

1. Conard, N.J. (2018): Als die moderne Kultur begann. Die Anfänge der Kunst und der Musik sowie die Bedeutung der Funde aus den Höhlen der Schwäbischen Alb. In: M. Wemhoff, M.M. Rind (eds.), Bewegte Zeiten. Archäologie in Deutschland. Petersberg: Michael Imhof Verlag, 298-309.
2. Conard, N.J & Janas, A. (2018): Fortsetzung der Ausgrabungen am Hohle Fels und die Entdeckung einer markierten Mammutrippe aus dem Gravettien. Archäologische Ausgrabungen in Baden-Württemberg 2017, 52-55.

3. Conard, N.J & Toniato, G. (2018): Fortsetzungen der paläolithischen Ausgrabungen am Abri Schafstall II im Lauchertal bei Veringenstadt. Archäologische Ausgrabungen in Baden-Württemberg 2017, 60-63.