



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

Annual Report of the Research Center for 2016

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*). By more than three million years ago hominins had established new ways to deal with their specific environment through culture. Cutting stone tools produced with the help of another 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 the 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 into 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 interdisciplinary, web-based georelational database known as ROAD (ROCEEH Out-of-Africa Database) with complete geographical information system (GIS) functionality. ROAD unifies geographical data about localities 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, and uses this information 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 an interdisciplinary research project situated at the interface between cultural and natural sciences. This far-reaching, international, scientific research is carried out by a team of 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, Karl Fuchs (Karlsruhe), Hermann H. Hahn (chairman, Karlsruhe), Lothar Ledderose (Heidelberg), 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. Bernhard Eitel (Heidelberg, through May 2016), Prof. Dr. Jürgen Richter (Köln), Prof. Dr. Wulf Schiefenhövel (Adechs), Prof. Dr. Mark Stoneking (Leipzig), Prof. Dr. Chris Stringer (London, through May 2016).

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

Research staff: in Frankfurt, Priv.-Doz. Dr. Angela Bruch, Claudia Groth, Priv.-Doz. Dr. Miriam Haidle (project coordinator), Dr. Christine Hertler, Dipl.-Biol. Julia Hess (administrative coordinator); in Tübingen, apl. Prof. Dr. Michael Bolus, Dipl.-Inf. Zara Kanaeva, Dr. Andrew Kandel, Dr. habil. Michael Märker, Sarah Rudolf.

Guests of the Research Center in 2016: Shaun Adams (Brisbane, Australia), Mariam Bundala (Dar es Salaam, Tanzania), Dr. Mariaelena Cama (Palermo, Italy), Dr. Jamie Clark (Fairbanks, USA), Dr. Ivan Gabrielyan (Yerevan, Armenia), Dr. Ruby Ghosh (Lucknow, India), Dr. Thomas Ingicco (Paris, France), Jacqueline Matthews (Crawley, Australia), Dr. Rebekka Volmer (Quezon City, Philippines). Additionally, the research center hosted two Humboldt Fellows, Prof. Dr. Fidelis Masao (Dar es Salaam, Tanzania) and Prof. Dr. Martin Porr (Crawley, Australia), who undertook research in connection with ROCEEH.

Key aspects

During the Research Center's ninth year, members of ROCEEH focused their efforts on investigating cultural innovation. Theoretical work examined the development of the capacity for cumulative culture along the pathway of human evolution. The typically human phenomenon of compounding cultural achievements in succession is often ascribed to a genetically inherited and specialized social competence. However, a detailed study of this phenomenon showed that the factors important to individual, social and environmental aspects influence each other simultaneously. Therefore, the development of cumulative

culture cannot be seen as happening at a specific point along the history of human development, but rather as a gradual developmental process seen in the evolutionary, individual and historic-social dimensions, with intermeshing elements that strengthen the relationships. One developmental model describes different steps of cumulative cultural ability, starting with the accumulation of traditions about cultural modifications, and extending into both simple and advanced transmitted culture. While the existence of an increased capability for cumulative culture allows for more complex forms of cultural expression, it does not necessarily lead to more efficient and complex solutions.

We approached the following question from two sides: Were the creators of the earliest stone tools ascribed to the Oldowan and its precursors able to innovate (cumulatively) between 3.3 and 1.7 million years ago? First we compared the knapping behavior of different ape species which employ a variety of techniques to produce simple cutting tools, examining the focus of attention and the technological steps and effects involved. The study indicates that early human behavior was not only more complex than the apes' behavior, but also showed a cultural variability that has as yet barely been examined. Then we assumed changed mechanisms of cultural propagation. These early changes in cultural behavior will be considered in terms of the potential for spatial expansion which they offered, that is, whether and to what degree expansions could have furthered human use of tools and the development of tool technologies. Several case studies about innovation compliment this focal point: 1) technical fire use and stone tools of the Middle Stone Age in South Africa; 2) expansion of ocher use during the Middle Paleolithic and Middle Stone Age; and 3) innovative behavior seen in a worked 250,000 year old piece of tuff from Berekhat Ram whose form resembles a female figurine.

Another focal point of 2016 looked at how cultural and natural dimensions interact and work upon each another with regard to the three types of expansion. The systematics of several environmental terms were defined and their relationships with one another were clarified. Especially for the term *resource space*, the environmental aspects were expanded using cultural components. With the help of an agent-based model, the interactions of many factors were studied. Two doctoral theses in ROCEEH apply agent-based modelling to answer different questions. One aims to compare different "Out-of-Africa" hypotheses, to build an integrative method which encompasses factors such as cultural population dynamics and environmental constraints. The other examines island migration and evolution of mammals on

islands. As shown by the hominid finds from the Indonesian island of Flores, hominids were also affected by such processes, but not excluded, because they had cultural versatility, flexibility, and an ability to adapt.

ROCEEH borrowed the concept of the *supply system* from the social sciences and applied it in a new way to observe the developmental history of humans. This concept allows us to better understand the connections among various material, social, behavioral and cognitive elements and observe the highly diversified effects caused by changes in any one of these elements. One case study dedicated to nutritional aspects of the *supply system* examines the diet of *Homo erectus* in order to reconstruct its habitat, most notably at the important hominin site of Sangiran in Indonesia. The sedimentary sequence here comprises layers spanning at least 500,000 years without large gaps. Most of the layers yielded fossils, which is not the case at the other hominid sites of Indonesia. At Sangiran, the layers illustrate not just a specific slice of time, but rather the overall evolution of *Homo erectus* and the dynamics of climate change during this time. Together with colleagues from the Center for Biodiversity and Climate Change in Frankfurt, members of ROCEEH developed a method to differentiate the amount of mother's milk compared to other dietary sources. The diet of *Homo erectus* in Sangiran is surprisingly variable, particularly during the weaning phase. The investigation of the diet of fossil antelopes – contemporaries and potential food sources of *Homo erectus* – shows a similar variability in its food spectrum. In the case of the antelope, the change is not distinctly associated with climatic and vegetational changes.

In order to place climatic and vegetational analyses in a broader framework, fossil micromammals will be included using a method developed by a member of ROCEEH. This method helps to quantify spatial and temporal climatic patterns and changes and correlate these changes with the expansion of early humans during the Pleistocene. To start, we reviewed published data on Middle Pleistocene European sites. Together with Dr. Lutz Maul, Senckenberg Weimar, we are assembling tables that are compatible with ROAD and include faunal, stratigraphic, sedimentological and paleoenvironmental data.

Newsletters providing current information on these themes can be accessed through ROCEEH's website (www.roceeh.net).

Field Work

In 2016 the staff of the Research Center conducted or participated in nine field projects:

Africa:

- South Africa: Umbeli Belli Rock Shelter, excavation and analysis (N. Conard, 4 weeks); Sibudu Cave, excavation and analysis (N. Conard, 7 weeks); geomorphological assessment in the vicinity, drone and GPS survey (M. Märker, C. Sommer, V. Schmid, 10 days)

Arabia:

- United Arab Emirates: Jebel Faya and Suhailah, excavation and survey, (K. Bretzke, 3 weeks)

West Asia:

- Iran: Djiroft, Mazayjan, Zagros. Geographical and geomorphological survey with focus on landscape development, geomorphological processes and forms (M. Märker, V. Hochschild, R. Zakerinejad, 2 weeks)

Caucasus:

- Georgia: Khvarbeti. Additional sampling of Khvarbeti profile for geochemical analysis and evaluation of mollusks (A.A. Bruch, F. Wesselingh, R. Fecker, 1 week)
- Armenia: Aghitu. Evaluation of finds from Aghitu 3 and survey (A.W. Kandel, 3 weeks)

Europe:

- Germany: Hohle Fels near Schelkingen, excavation (S. Rudolf, N. Conard, 8 weeks)
- Italy: Mugello Field school (Geo51) for geomorphological and soil analysis (M. Märker, H. Rosner, 1 week)

Southeast Asia:

- India: Central Narmada Valley (Madhya Pradesh), Bhimbetka and Patne (Maharashtra), review of archaeological, paleoanthropological and paleontological hominid sites in North India; preparatory work for potential cooperation (C. Hertler, A.W. Kandel, M. Porr, P. Chauhan, R. Patnaik, 3 weeks)

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

The coding of ROAD was changed from ISO 8859-15 (Latin-9) to UTF-8 and related customization of ROADWeb was completed. As every year, the user friendliness of

ROADWeb was enhanced and the modification of ROADWeb was improved based on the needs of those who use it. The views of several tables were improved with the addition of more complementary information. Another addition was the introduction of a new toolbox that simplified the processing of series of data. The toolbox automatically implemented queries for different user-defined time slices and time intervals within a specified period. In addition to these upgrades, a beta version of the query tool was implemented in ROADWeb, with the result that queries can now be run on selected regions or details of maps. The process is initiated by the user who defines a polygon around the region of interest in the Map Module. We also initiated the programming of an interface between the NetLogo Model and ROADWeb. This interface will allow the results of saved simulations to be shown as an animation in the OpenLayers Client Program for an unlimited number of users. Together with colleagues from Spain and Italy the linking of ROAD with other databases intensified. The Map Module was reconfigured as a shared interface, and a series of queries allows several data sources to be displayed and analyzed together. During a workshop of the INQUA (OFG 1604F) working group, “Modelling Environmental Dynamics and Hominin Dispersals around the Mid-Pleistocene Revolution (METHOD)” an introduction to ROAD and the ROADWeb query was presented to an expanded user group, with regular future meetings planned.

Project relevant conference contributions and lectures by research staff

The staff of the Research Center participated in 21 conferences. They helped organize the international conference “100+25 years of Homo erectus: Dmanisi and beyond Tbilisi” and co-organized three workshops. An additional workshop on the early settlement of Arabia was sponsored by ROCEEH. The staff were lead or contributing authors in 22 lectures and presented seven posters. They also introduced the project or their work seven 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 Research Council (DFG), the Erasmus Mundus Program “Quaternary and Prehistory”, the International Union for Quaternary Research (INQUA), the International Research Staff Exchange Scheme (IRSES) of the European Union, the Comisión Nacional de Investigación, Ciencia y Tecnología (CONICYT), and the Hermann Willkomm 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
- Supervision of Master's, Diploma and Doctoral theses: Michael Bolus, Angela Bruch, Miriam Haidle, Christine Hertler, Michael Märker
- Supervision of archaeotechnical trainees: Sarah Rudolf

Project relevant publications by research staff and principal investigators

A total of 54 project relevant publications appeared in 2016 in which the principal investigators and staff of the Research Center played a leading or contributing role:

ISI-listed publications (25):

1. Angileri, S.A., Conoscenti, C., Hochschild, V., Märker, M., Rotigliano, E. & Agnesi, V. (2016): Water erosion susceptibility mapping by applying stochastic gradient treeboost to the imera Meridionale River basin (Sicily, Italy). *Geomorphology*, 262, 61-76.
2. Bachofer, F., Quénehervé, G., Zwiener, T., Märker, M. & Hochschild, V. (2016): Comparative analysis of edge detection techniques for SAR images. *European Journal of Remote Sensing* 49, 205-224.
3. Bromage, T., Idaghdour, Y., Lacru, R., Schrenk, F. et al. (2016): The Swine Plasma Metabolome Chronicles "Many Days" Biological Timing and Functions Linked to Growth. *PLoS ONE* 11(1):e0145919.
4. Coolidge, F.L., Haidle, M.N., Lombard, M. & Wynn, T. (2016): Bridging theory and bow hunting: human cognitive evolution and archaeology. *Antiquity* 90, 219-228.
5. Delagnes, A., Schmidt, P., Douze, K., Wurz, S., Bellot-Gurlet, L., Conard, N.J., Nickel, K.G., van Niekerk, K.L. & Henshilwood, C.S. (2016): Early Evidence for the Extensive Heat Treatment of Silcrete in the Howiesons Poort at Klipdrift Shelter (Layer PBD, 65 ka), South Africa. *PLOS ONE* 11(10): e0163874.

6. Fu, Q., Posth, C., Hajdinjak, M., Petr, M., Mallick, S., Fernandes, D., Furtwängler, A., Haak, W., Meyer, M., Mittnik, A., Nickel, B., Peltzer, A., Rohland, N., Slon, V., Talamo, S., Lazaridis, I., Lipson, M., Mathieson, I., Schiffels, S., Skoglund, P., Derevianko, A. P., Drozdov, N., Slavinsky, V., Tsybankov, A., Grifoni Cremonesi, R., Mallegni, F., Gély, B., Vacca, E., González Morales, M.R., Straus, L.G., Neugebauer-Maresch, C., Teschler-Nicola, M., Constantin, S., Teodora Moldovan, O., Benazzi, S., Peresani, M., Coppola, D., Lari, M., Ricci, S., Ronchitelli, A., Valentin, F., Thevenet, C., Wehrberger, K., Grigorescu, D., Rougier, H., Crevecoeur, I., Flas, D., Semal, P., Mannino, M.A., Cupillard, C., Bocherens, H., Conard, N.J., Harvati, K., Moiseyev, V., Drucker, D.G., Svoboda, J., Richards, M.P., Caramelli, D., Pinhasi, R., Kelso, J., Patterson, N., Krause, J., Pääbo, S. & Reich, D. (2016): The genetic history of Ice Age Europe. *Nature* 534, 200-205.
7. Heckel, C., Müller, K., White, R., Wolf, S., Conard, N.J., Normand, C., Floss, H. & Reiche, I. (2016): F-content variation in mammoth ivory from Aurignacian contexts: Preservation, alteration, and implications for ivory-procurement strategies. *Quaternary International* 403, 40-50.
8. Hölzchen, E., Hertler, C., Timm, I. & Lorig, F. (2016): Evaluation of Out of Africa hypotheses by means of agent-based modeling. *Quaternary International* 413: 78-90..
9. Kandel, A.W. Bolus, M., Bretzke, K., Bruch, A.A., Haidle, M.N., Hertler, C. & Märker, M. (2016): Increasing behavioral flexibility? An integrative macro-scale approach to understanding the Middle Stone Age of Southern Africa. *Journal of Archaeological Method and Theory* 23 (2), 623-668.
10. Lombardo, L., Bachofer, F., Cama, M., Märker, M., & Rotigliano, E. (2016): Exploiting Maximum Entropy method and ASTER data for assessing debris flow and debris slide susceptibility for the Giampileri catchment (north-eastern Sicily, Italy). *Earth Surface Processes and Landforms*, 41 (12), 1776-1789.
11. Lüdecke, T., Mulch, A., Kullmer, O. & Schrenk, F. (2016): Stable isotope dietary reconstructions of herbivore enamel reveal heterogeneous savanna ecosystems in the Plio-Pleistocene Malawi Rift. *Palaeogeography Palaeoclimatology Palaeoecology* 459, 170-181.
12. Lüdecke, T., Schrenk, F., Thiemeyer, H., Kullmer, O., Bromage, T.G., Sandrock, O., Fiebig, J. & Mulch, A. (2016): Persistent C3 vegetation accompanied Plio-Pleistocene hominin evolution in the Malawi Rift (Chiwondo Beds, Malawi). *Journal of Human Evolution* 90, 163-175.

13. Märker, M., Hochschild, V. Maca, V. & Vilimek, V. (2016): Stochastic assessment of landslides and debris flows in the Jemma basin, Blue Nile, Central Ethiopia. *Geographia Fisica e Dinamica Quaternaria*. 39, 51-58.
14. Maul, L.C., Smith, K.T., Shenbrot, G., Bruch, A.A., Barkai, R. & Gopher, A. (2016): Palaeoecological and biostratigraphical implications of the microvertebrates of Qesem Cave in Israel. *Quaternary International* 398, 219-232.
15. Omran, A., Schröder, D., Abdou, A. & Märker, M.. (2016): New ArcGIS tools developed for stream network extraction and basin delineations using Python and java script. *Computers & Geosciences*, 94, 140–149.
16. Posth, C., Renaud, G., Mittnik, A., Drucker, D.G., Rougier, H., Cupillard. C., Valentin, F., Thevenet, C., Furtwängler, A., Wißing, C., Francken, M., Malina, M., Bolus, M., Lari, M., Gigli, E., Capecchi, G., Crevecoeur, I., Beauval, C., Flas, D., Germonpré, M., van der Plicht, J., Cottiaux, R., Gély, B., Ronchitelli, A., Wehrberger, K., Grigorescu, D., Svoboda, J., Semal, P., Caramelli, D., Bocherens, H., Harvati, K., Conard, N.J., Haak, W., Powell, A. & Krause, J. (2016): Pleistocene Mitochondrial Genomes Suggest a Single Major Dispersal of Non-Africans and a Late Glacial Population Turnover in Europe. *Current Biology* 26, 827-833.
17. Rodríguez, J., Mateos, A., Hertler, C. & Palombo, M.R. (2016): Modelling human presence and environmental dynamics during the Mid-Pleistocene Revolution: New approaches and tools. *Quaternary International* 393, 19-23.
18. Rodríguez, J., Mateos, A., Hertler, C. & Palombo, M.R. (2016) (volume eds): The power of models: Mathematical approaches to the study of human-fauna interactions in the Pleistocene. *Quaternary International* 413, 2-6.
19. Sala, N. & Conard, N.J. (2016): Taphonomic analysis of the hominin remains from Swabian Jura and their implications for the mortuary practices during the Upper Paleolithic. *Quaternary Science Reviews* 150, 278-300.
20. Uhl, A., Mentzer, S.M. & Kandel, A.W. (2016): Fifth Annual Meeting of the European Society for the Study of Human Evolution. *Evolutionary Anthropology* 25, 41-42.
21. Vogel, S., Märker, M., Rellini, I., Hoelzmann, P., Wulf, S., Robinson, M., Steinhübel, L., Di Maio, G., Imperatore, C., Kastenmeier, P., Liebmann, L., Esposito, D. & Seiler, F. (2016): From a stratigraphic sequence to a landscape evolution model: Late Pleistocene and Holocene volcanism, soil formation and land use in the shade of Mount Vesuvius (Italy). *Quaternary International* 394, 155-179.

22. Vogel, S., Märker, M., Esposito, D. & Seiler, F. (2016): The Ancient Rural Settlement Structure in the Hinterland of Pompeii Inferred from Spatial Analysis and Predictive Modeling of Villae Rusticae. *Geoarchaeology* 31(2), 121-139.
23. Volmer, R. & Hertler, C. (2016): The effect of competition on shared food resources in carnivore guilds. *Quaternary International* 413, 32-43.
24. Volmer, R., Hertler, C. & van der Geer, A. (2016): Niche overlap and competition potential among tigers (*Panthera tigris*), sabertoothed cats (*Homotherium ultimum*, *Hemimachairodus zwierzyckii*) and Merriam's Dog (*Megacyon merriami*) in the Pleistocene of Java. *Palaeogeography, Palaeoclimatology, Palaeoecology* 441, 901-911.
25. Will, M., Kandel, A.W., Kyriacou, K. & Conard, N.J. (2016): An evolutionary perspective on coastal adaptations by modern humans during the Middle Stone Age of Africa. *Quaternary International* 404B, 68-86.

Other peer reviewed publications (14):

1. Bader, G.D., Cable, C., Lentfer, C. & Conard, N.J. (2016): Umbeli Belli Rock Shelter, a forgotten piece from the puzzle of the Middle Stone Age in KwaZulu-Natal, South Africa. *Journal of Archaeological Science: Reports* 9, 608-622.
2. Bocherens, H., Drucker, D.G, Haidle, M.N., Müller-Beck, H., Münzel, S.C. & Naito, Y.I. (2016): Isotopic evidence (C, N, S) for a high aquatic dietary contribution for a Pre-Dorset muskox hunter from Umingmak (Banks Island, Canada). *Journal of Archaeological Science: Reports*, 6, 700-708.
3. Bolus, M. (2016): Tracing Group Identity in Early Upper Paleolithic Stone and Organic Tools – Some Thoughts and Many Questions. In: M. N. Haidle, M. Bolus and N. J. Conard (eds.), *The Nature of Culture: Based on an Interdisciplinary Symposium 'The Nature of Culture'*. Tübingen, Germany. *Vertebrate Paleobiology and Paleoanthropology Series*. Dordrecht: Springer, 79-85.
4. Camarós, E., Münzel, S.C., Cueto, M., Rivals, F. & Conard, N.J. (2016): The evolution of Paleolithic hominin–carnivore interaction written in teeth: Stories from the Swabian Jura (Germany). *Journal of Archaeological Science: Reports* 6, 798-809.
5. Garofoli, D. (2016): Metaplasticities: Material engagement meets mutational enhancement. In: Etzelmüller, Gregor & Christian Tewes (eds.), *Embodiment in evolution and culture*. Tübingen: Mohr Siebeck, 306-335.

6. Haidle, M.N. (2016): Lessons from Tasmania – cultural performances versus cultural capacities. In: Haidle, Miriam Noël, Nicholas J. Conard & Michael Bolus (eds.), *The Nature of Culture. Based on an Interdisciplinary Symposium ‘The Nature of Culture’, Tübingen, Germany.* Dordrecht: Springer, 7-17.
7. Haidle, M.N., Conard, N.J. & Bolus, M. (eds.) (2016): *The Nature of Culture. Based on an Interdisciplinary Symposium ‘The Nature of Culture’, Tübingen, Germany.* Dordrecht: Springer.
8. Münzel, S.C., Conard, N.J., Hein, W., Gill, F. & Potengowski, A.-F. (2016): Interpreting Three Upper Palaeolithic Wind Instruments from Germany and One from France as Flutes. (Re)construction, Playing Techniques and Sonic Results. In: R. Eichmann, L.-C. Koch & F. Jianjun (eds.), *Studien zur Musikarchäologie X: Klang – Objekt – Kultur – Geschichte.* Rahden/Westf.: Verlag Marie Leidorf, 225-243.
9. Porraz, G., Schmid, V.C., Miller, C.E., Tribolo, C., Cartwright, C.C., Charrié-Duhaut, A., Igreja, M., Mentzer, S., Mercier, N., Schmidt, P., Conard, N.J., Texier, P.-J. & Parkington, F.E. (2016): Update on the 2011 excavation at Elands Bay Cave (South Africa) and the Verlorenvlei Stone Age. *Southern African Humanities* 29, 33-68.
10. Timm, I.J., Lorig, F., Hölzchen, E. & Hertler, C. (2016): Multi-Scale Agent-Based Simulation of Long-Term Dispersal Processes: Challenges in Modeling Hominin Biogeography and Expansion. In: Barceló, J.A., Del Castillo, F. (eds.): *Simulating Prehistoric and Ancient Worlds.* Springer, Cham, 141-159.
11. Schmid, V.C., Conard, N.J., Parkington, J.E., Texier, P.-J. & Porraz, G. (2016): The ‘MSA 1’ of Elands Bay Cave (South Africa) in the context of the southern African Early MSA technologies. *Southern African Humanities* 29, 153-201.
12. Will, M. & Conard, N.J. (2016): Assemblage variability and bifacial points in the lowermost Sibudan layers at Sibudu, South Africa. *Archaeological and Anthropological Sciences*, 1-26.
13. Wolf, S., Münzel, S.C., Dotzel, K., Barth, M.M. & Conard, N.J. (2016): Projectile Weaponry from the Aurignacian to the Gravettian of the Swabian Jura (Southwest Germany): Raw Materials, Manufacturing and Typology. In: M. C. Langley (ed.), *Osseous Projectile Weaponry. Towards an Understanding of Pleistocene Cultural Variability.* Dordrecht: Springer, 71-87.
14. Zakerinejad, R., Hochschild, V., Rahimi, M. & Märker, M. (2016): Morphotectonic analysis of the Zagros Mountains Using High Resolution DEM to Assess Gully

Erosion Processes: A case Study in the Fars Province, Southwest of Iran. *International Geoinformatics Research and Development Journal* 7(1), 1-17.

Publications without peer review (7):

1. Conard, N.J. (2016): Baaz Rockshelter (Damascus). In: J. Kanjou & A. Tsuneki (eds.), *A History of Syria in One Hundred Sites*. Oxford: Archaeopress, 24-26.
2. Conard, N.J. (2016): Kaus Kozah Cave (Damascus). In: J. Kanjou & A. Tsuneki (eds.), *A History of Syria in One Hundred Sites*. Oxford: Archaeopress 27-30.
3. Conard, N.J. (2016): Wadi Mushkuna Rockshelter (Damascus). In: J. Kanjou & A. Tsuneki (eds.), *A History of Syria in One Hundred Sites*. Oxford: Archaeopress, 21-23.
4. Conard, N. J., M. Schumacher und M. Bolus (2016): New Research on Eduard Peters' Excavations at Schafstall II Rockshelter in the Lauchert Valley of Southwest Germany. *Mitteilungen der Gesellschaft für Urgeschichte* 25, 87-103.
5. Haidle, M.N. (2016): Introduction to Part 4. The mutual intertwinement of nature and culture. In: Etzelmüller, Gregor & Christian Tewes (eds.), *Embodiment in evolution and culture*. Tübingen: Mohr Siebeck, 285-288.
6. Haidle, M.N., Conard, N.J. & Bolus, M. (2016): The nature of culture: research goals and new directions. In: Haidle, Miriam Noël, Nicholas J. Conard & Michael Bolus (eds.), *The Nature of Culture. Based on an Interdisciplinary Symposium 'The Nature of Culture'*, Tübingen, Germany. Dordrecht: Springer, 1-6.
7. Serangeli, J. & Conard, N.J. (2016): Die Ausgrabungen in Schöningen 2008–2016. Eine wissenschaftliche Bilanz. *Nachrichten aus Niedersachsens Urgeschichte* 84/2016, 11-29.

Popular publications (8):

1. Bolus, M. (2016): Paläolithikum: Ernährung in der älteren und mittleren Altsteinzeit – Fleisch garen am Feuer – 600 000 bis um 30 000 Jahre vor heute. In: S. Hilz-Wagner (Hrsg.), *Am Anfang war der Feuerstein. Kulturführer durch 600 000 Jahre Ess- und Trink-geschichte(n) aus der Region Baden-Württemberg*. Karlsruhe: Hilz-Wagner, 11-15.
2. Conard, N.J. (2016): Die Erforschung des Achtals – eine Aufgabe für Generationen. *Archäologie in Deutschland* 2016, 28-31.

3. Conard, N.J. (2016): Das Vogelherdpferd und die Ursprünge der Kunst. Tübingen: Museum der Universität Tübingen, 1-90.
4. Conard, N.J. (2016): The Vogelherd Horse and the Origins of Art. Tübingen: Museum der Universität Tübingen, 1-90.
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