

Der dritte Abschnitt des Bandes steht unter dem Titel “The rise of salt exploitation” (S. 123–179) und fokussiert auf den Zusammenhang zwischen den frühen, in Landwirtschaft und Viehzucht begründeten Gemeinden und der Salzgewinnung. Takamune Kawashima erforscht Herkunft und Entwicklung der Salzproduktion sowie die damit verbundenen sozioökonomischen Veränderungen auf Japans Inseln in den letzten drei Jahrtausenden v. Chr. Aufgrund der bekannten Salzquellen in Transsilvanien (Rumänien) stellen Gheorghe und Cornelia-Magda Lazarovici ihre Überlegungen über die möglichen Handelswege dieses Produkts nach West und Ost während der späten Urgeschichte und der Antike an. Die Herausgeber des Bandes, Robin Brigand und Olivier Weller, legen in ihrem Beitrag die Projektergebnisse zur Raumanalyse des moldawischen Neolithikums (Rumänien) mit dem Hauptaugenmerk auf der Dynamik der Salzgewinnung vor. Untersucht wurde insbesondere die Beziehung zwischen der Verteilung der Salzfundstellen und den Ansiedlungsmodellen in der Zeit zwischen dem frühen Neolithikum und dem Chalkolithikum, wobei zu diesem Zweck die Möglichkeiten Geografischer Informationssysteme (GIS) getestet wurden.

Der vierte Abschnitt „Historical themes” (S. 181–220) des hier besprochenen Bandes ist ausschließlich auf die römische Epoche gerichtet. Ulrich Stockingers Untersuchung führt einige verstreute Belege für die Salzgewinnung in den westlichen Provinzen des Römischen Reichs zusammen und diskutiert die möglichen Handelswege des Salzes sowie die ökonomische Bedeutung dieses Rohstoffs. Thomas Saile untersucht den Rhythmus der Salzherstellung in Zentraleuropa zur Zeit der Expansion des Römischen Reichs nördlich der Alpen. Die lokale Produktion versiegt zugunsten des Salzimports aus dem Mittelmeerbereich. Dem Salz in der Provinz Britannia widmet sich Isabella Tsigarida. Sie hebt hervor, dass dort die Nachfrage nach Salz besonders anstieg, als zahlreiche römische Militäreinheiten stationiert wurden, was auch die lokale Produktion wieder ankurbelte. Der Artikel zeigt auch eine Reihe von Beweisführungen für die Salzproduktion und die entsprechende Infrastruktur auf.

Der Band “Archaeology of Salt” bietet sowohl neue Erkenntnisse als auch gute Zusammenfassungen von bisher verstreut vorliegenden Daten zur Salzgewinnung in Europa, dem Fernen Osten, Afrika und Südamerika in der späten Urgeschichte, der Antike, dem Mittelalter und in der ethnografischen Gegenwart. In beiden Hinsichten kann er als ein überzeugender Beitrag zu einer nicht gerade gut bekannten Problemstellung aus dem Leben im Altertum angesehen werden.

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**BEATE MARIA POMBERGER, Wiederentdeckte Klänge. Musikinstrumente und Klangobjekte vom Neolithikum bis zur römischen Kaiserzeit im mittleren Donaauraum.** Universitätsforschungen zur Prähistorischen Archäologie Volume 280. Verlag Dr. Rudolf Habelt GmbH, Bonn 2016. € 85.00. ISBN 978-3-7749-4006-2. 404 pages, 139 figures, 56 plates, 3 foldouts and 131 tables.

During the past three decades, interest in music-archaeological artefacts and contexts has steadily increased. Advanced studies continue to depend on catalogues of music-archaeological sources systematically dealing with the inventory of artefacts, which is the case with this dissertation by Beate Maria Pomberger on the music archaeology of the middle Danube region, submitted to the Insti-

tut für Ur- und Frühgeschichte und Historische Archäologie at the University of Vienna. The author does not claim that her survey of archaeological evidence is complete, but considers it to be “groundwork for further research” (p. 12).

The work is adequately described in the German / English summary (pp. 227–228): 385 musical instruments and sound-producing objects were considered, dating from the Neolithic to the Roman Empire in the geographic area between the Salzach river and the Danube Bend, which includes parts of Austria, the Czech Republic, Slovakia, Hungary, and Slovenia. These are primarily idiophones, membranophones and aerophones, which are classified culturally, chronologically and typologically. The author also addresses the acoustic characteristics of the sound-producing objects (how sounds are generated, the tone reservoir, frequencies) and their discernibility in free sound field (range). The brief overview of the research history concentrates on music-archaeological activities in Austria. The short section on the state of research internationally is highly summarized and incomplete. The predominantly descriptive main text (228 pp.) is supplemented by a chronologically-organized object catalogue with the information customary for prehistoric research (73 pp.), literature (21 pp.), maps (25 pp.), 56 plates, and three foldouts with very useful typological-chronological overviews; in addition, there are photographs and frequency analysis diagrams that can be accessed from an internet address supplied at the end of the table of contents.

The work is characterized by the author’s special interest in the development of sound-producing objects over a lengthy period of time (6<sup>th</sup> millennium BC to the first half of the 1<sup>st</sup> millennium AD), their chronology and chorology, classification methodologies, and experimental archaeological and systematic acoustic analyses. It is her opinion that there is “no other such work worldwide” (p. 12) dealing with musical instruments and sound-producing objects from prehistoric contexts that takes particular account of their acoustic characteristics. Indeed, archaeoacoustics is still a relatively new field of research, but it has become increasingly visible already since the 1980s (e. g.: I. REZNIKOFF / M. DAUVOIS, *La dimension sonore des grottes ornées*. Bull. Soc. Préhist. Française 85,8, 1988, 238–246). In 2006 C. SCARRE and G. LAWSON published a ground-breaking collection of papers on “Archaeoacoustics” (Cambridge 2006); in 2014 L. C. ENEIX and E. B. W. ZUBROW followed with the volume “Archaeoacoustics: The Archaeology of Sound” (Myakka City, Florida), which contains several contributions of varying scientific depth. Already in 2010 Chr. Berends published his dissertation on “Klänge der Bronzezeit” (Sounds of the Bronze Age; CHR. BERENDS, *Klänge der Bronzezeit. Musikarchäologische Studien über bronzzeitliche Hortfunde Mitteldeutschlands*. Uniforsch. Prähist. Arch. 187 [Bonn 2010]; reviewed in *Germania* 91, 2013 [2010], 203–205), in which he considers such topics as sound characteristics, intensity, tone reservoir and soundscapes and includes a CD with sound samples. For methodological reasons this particular publication should have been considered here.

The new aspect of this study, compared with Chr. Berends’ dissertation, is a more systematic documentation of the acoustic ranges of (over 150) sound-generating objects, including 28 experimental reproductions, assuming an ambient noise level of 42 dB (p. 19) in a free sound field. This forms the basis for conclusions about the historical perception of sound-generating objects, supported by readily comprehensible graphics. The sound of the tested objects unfortunately is not substantiated by audio samples, but can be verified by visualised frequency analyses.

Compared with Egypt, Mesopotamia or China, fewer European music-archaeological sources have survived and they are more fragmented. They are nonetheless informative, such as the late Palaeolithic wind instruments from the Swabian Alb or lurs from northern Germany and southern Scandinavia. Music archaeology in the study area is complicated by ambiguities in the identification of sound-producing objects and musical instruments and much effort is sometimes required to arrive at an interpretation. Here the author either draws on earlier interpretations or presents

her own, whereby object descriptions and music-archaeological interpretations are not always clearly distinguished. The result is one-sided interpretation.

For example, a hole in a fairly massive, horn-shaped artefact with a small cavity in the wider part is identified as a 'finger hole' because the object (vaguely) resembles a medieval wind instrument: "the only object [...] that can be interpreted as a musical instrument and an idol is a horn-shaped pottery find with four finger holes [...]" (p. 38). The object "resembles a *Gemshorn*, an ocarina, popular in the Late Medieval Period and Renaissance, and can therefore be regarded as such". As a matter of fact, there are large differences between the two, but this is not specifically mentioned. Whether alternative assignments of function could be considered was not tested, nor is an analysis included which deals with the perforations and patina that could have been caused by use. Moreover, the accompanying construction drawings and photographs have only limited indicative value.

Other examples are the cylindrical- and hourglass-shaped pottery vessels which are being interpreted in analogy to modern instruments as tubular drums covered with animal hide membranes, although there is no evidence of a significant patina which would allow suggesting the fixation of membranes. This is only partially convincing. Whether they could in some cases have the reasonable function of stands for round-bottomed vessels, as found in the ancient Near East, was not examined (e. g., unpublished master's thesis in the field of Oriental archaeology: N. HAJ DARWICH, *Gefäßständer und zugehörige Gefäße der Mittel- und Spätbronzezeit in Mesopotamien* [Vessel Stands and the Accompanying Vessels in Middle and Late Bronze Age Mesopotamia] [Halle 2006] a PDF version can be found on: [www.academia.edu](http://www.academia.edu)).

Original objects were used for the acoustic investigations; if originals were unavailable or survived only in fragments, reproductions made of fast curing modelling dough were put to use. Although this procedure can supply useful results, at least for reconstructing acoustic and sound characteristics, care is required in the case of pitch measurements. Even in modern serially produced flutes or those made by 3D printing there are perceptible differences in interval size from instrument to instrument. However, the methodically sound acoustic investigations justify statements based on quantifiable data about the volume, how far away individual sound tools can be heard, and the number of listeners who can be reached. These results are visualized with convincing diagrams. They make it clear that whistles can be heard at a long distance, for example 150 m for specimens made of bone. Pottery horns can be heard 90 m away. This suggests that both would make good signalling instruments. The same is probably true for bells dating from the time of the Roman Empire; in some cases, they can be heard for 100 m. Neolithic drums can be heard up to 40 m away. More discrete sound tools include Metal Age fibulas with flat metal jingles, and decorative belt pendants; these can usually not be heard beyond a distance of one metre.

In her effort to find plausible interpretations of function the author sometimes turns to speculation. For example, a rattle that could be heard at a distance of some 2 to 3 m could have „possibly been hung above an infant's place of sleep so that it could be entertained by this sound" (p. 45). A feature of a wind instrument is similarly interpreted: two perforations on a fully preserved late Neolithic pottery horn are explained as attributes to attach a leather strap or a cord, "so that it could be hung on a wall" (p. 54 f.), without any supporting evidence (such as a revealing find context near a wall).

One purpose of this work is to investigate whether particular objects of daily use were employed as sound tools. Analogous to recent experience with such objects as metal cutlery, glasses, bottles, pots, lids, cans, boxes, and combs being used as idiophones, this assumption is certainly legitimate. It is therefore possible that resonant pottery container lids could have been used already in the

Middle Neolithic as *Hänge-Schlägelglocken* (hanging bells sounded by striking them, p. 49; idio-phones pp. 200–208).

There are only a few prehistoric musical instruments and sound-generating objects from the study area, and they are all made of bone, horn, metal or pottery. Considering the survival conditions for archaeological finds in other parts of the world it can be assumed that there could also have been instruments made of plant material. Two- and three-dimensional representations of music scenes and instruments supporting this conclusion are only available starting with the early Iron Age. Some striking changes in sound production in the research area are noteworthy: whistles made from long bones appear beginning with the Neolithic, and a late Neolithic bone ensemble can be reconstructed as panpipes. From the Neolithic and Bronze Age there is as yet no evidence of wind instruments capable of producing low-pitched sounds (“in the small and great octaves”). In the study area they appear only in the Iron Age in the form of brass wind instruments, the carynces. According to iconographic representations the wind instrument inventory was augmented by reed instruments at the latest in the Iron Age.

Goblet- and hourglass-shaped pottery forms that can be interpreted as drums have been dated to the Middle and Late Neolithic and to the Early Bronze Age. The disappearance of pottery drums is attributed to the susceptibility of the material to mechanical stress cracking, which awaits experimental confirmation. Iconographic indications of the use of frame drums date from the Iron Age.

The first clapper bell dates from the Iron Age and is made of pottery. Tinkling bronze jewellery characteristic of the Metal Ages disappeared in the La Tène period. Bronze bells containing iron pellets were elements of horse bridles and there is evidence for them from the late Bronze Age / early Iron Age. They were medium-loud and could be heard at distances up to some 15 m.

During the Roman Empire the diversity of the musical instrument and sound tool inventory seems to have increased. Tuning pegs and perforated bone tubes are evidence of the use of string and reed instruments, both of which were known in the study area by the Iron Age at the latest, however only from iconographic evidence. Organs are among the innovative instruments dating from the Roman Empire (Aquincum find). Considered as a whole, sound-generating objects seem to have become louder at this time, which suggests larger audiences.

The work reviewed here is a useful regional study presenting the state of current knowledge in temporal depth and against the background of European music archaeology. Such studies are essential for stimulating neighbouring sciences (such as musicology, music ethnology, social sciences, cultural studies) to undertake interdisciplinary research. The methodological investigation of characteristic features of musical instruments and sound-generating objects (volume, range, tone reservoir), which allows not only the quantification of acoustic phenomena but also their sociocultural assessment in a verifiable form, is an innovation in the field of music archaeology. Controversial interpretations will surely stimulate discussion in the field and contribute to refining music-archaeological methodologies.

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