

'Parity features' and social status at prehistoric sites in Austria

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Introduction

Within the framework of the ERC-project "The value of mothers to society" (VAMOS), we are investigating motherhood in prehistory. The potential of this bio-archaeological study lies in the opportunity to analyze extensive skeletal series housed at the Natural History Museum in Vienna, spanning a long time period (c. 3000-15 BC, Late Neolithic to Late Iron Age), together with their archaeological background. Pregnancy and childbirth are formative events for women and may leave physical traces on the female skeleton. Kinship relations between individuals who were buried together in double, triple, and multiple burials will be clarified using aDNA analyses. Furthermore, the social status (social index value – SI) of the buried individuals will be inferred through archaeological observations; grave depth and details of grave construction and number and value of co-buried objects are taken into consideration.



Fig. 2. Burial 122B:

Left os ilium, frontal view:
female individual, 17–20 years, 156 cm tall;
preauricular sulcus (r/l): slightly expressed
(fi-/fim, stage 2 both sides);
small extended pubic tubercle, and,
located posteriorly at the pecten ossis pubis,
ridge like elevation (arrows);

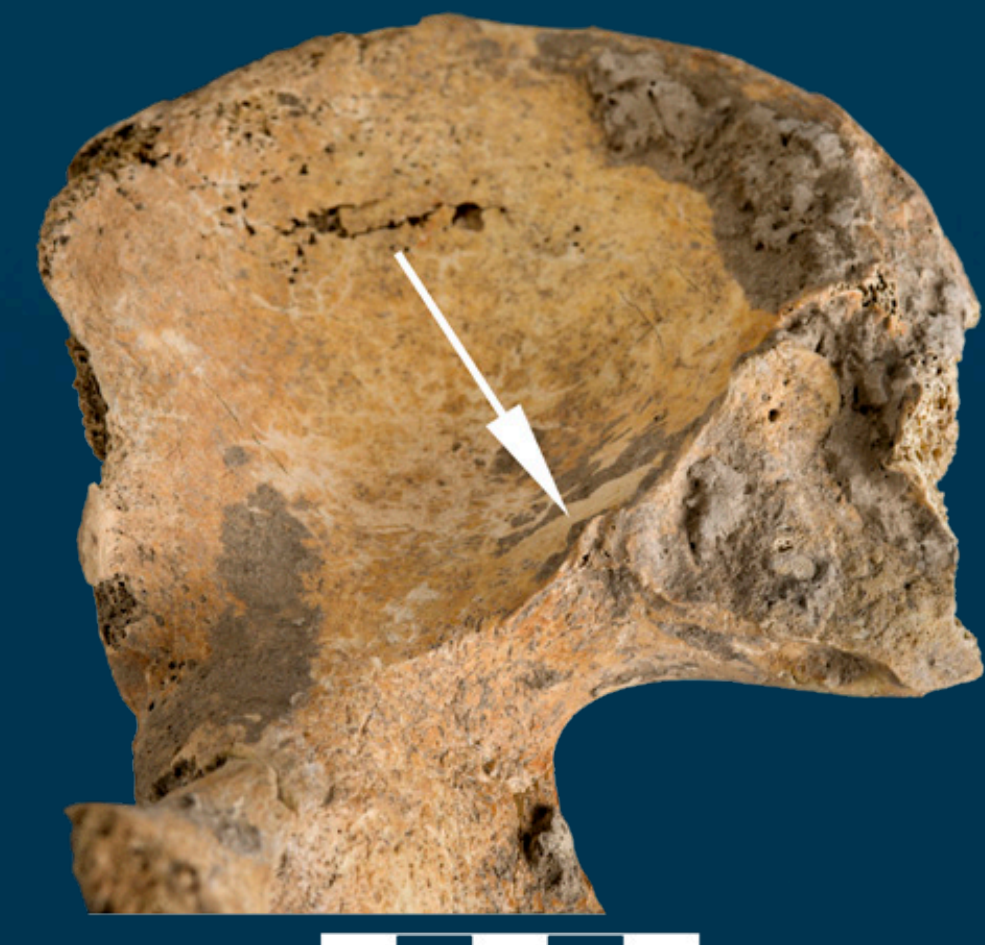


Fig. 3. Burial 93B:

Right os ilium, frontal view;
female individual, 35–45 years, 161.4 cm tall;
preauricular sulcus (r/l): moderately/slightly
expressed (fif/iif, stage 3/2);
corresponding facet at anterior-superior
margin of auricular facies (arrow) from
auriculate extension at os sacrum;
a margo auricularis groove was
detected at the os sacrum on both sides;



Fig. 4. Burial 93B:

Os sacrum, right lateral view:
bilateral auriculate extension at
the anterior-superior margin of
the sacrum bone (arrow), with
a corresponding facet at the
ilium (dimension ca. 1 x 1 cm,
compare arrow Fig. 2);
possible sacralization of L5
(not shown);



fig. 5 Burial 109A:

Right os ilium, frontal view:
female individual,
40–60 years, 161.7 cm tall;
preauricular sulcus (r/l):
not/slightly expressed
(mmi/fi-, stage 1/2, compare Fig. 6);
Right ilium shows a huge,
tongue-like exostosis (ca. 1.5 x 2 cm)
at the anterior-superior margin of
right auricular facies (arrow) with
corresponding facet at os sacrum (see Fig. 5);
found with neonatal remains;



fig. 6 Burial 109A:

Right os ilium,
linked to os sacrum by a tongue-like
exostosis at the anterior-superior margin;
osteophyte formation at L4/L5
(not shown);



Fig. 7. Burial 109A:

Left os ilium,
preauricular sulcus (l):
slightly expressed
(fi-, stage 2);



fig. 8 Burial 109A:

left os pubis, ventral view,
unclear (eroded) extended
tuberculum pubicum and,
located posteriorly,
ridge-like elevation (arrow);
further, exostoses and
lesions at left ventral
symphysis;

Results

Concerning the results from the Bronze Age pilot study sample from Unterhautzenthall (N adults = 31), sex determination from the skull and the pelvic bones was mostly consistent with archaeological findings. Five females were found to be buried with neonates and children. Unfortunately, two of them, juvenile mothers, had no pelvic remains preserved. However, aDNA analysis for kinship relations is pending. On sample level, significant results according to female sex and pelvic features were obtained for the preauricular sulcus ($p = .001$, Fisher's exact test, Monte Carlo 95%, high Cramer's V (.820), Kendall's tau c: $\tau = .000$), and exostoses at the sacroiliac joint ($p = .007$, Fisher's exact test, Kendall's tau b: $\tau = .008$). Males and females show a distinct sexual dimorphism: from the largest femoral length measurements, females show a mean body height of 156.9 cm, males of 165.5 cm (Ruff et al. 2012). Relating to this, a statistically significant association was found for short stature and moderate to strong expressions of the preauricular sulcus ($p = .015$, ANOVA between groups, Fig. 1). Among those are the two females with the shortest stature in the group (150.6 and 143.1 cm) showing a true preauricular groove (fff = F, Brůžek 2002) respectively, stages 3 and 4, not found in males). Additionally, concerning the other features, bilateral distinct formation of exostoses was found at the ilial part of the sacroiliac joint in both of them. Two other females revealed peculiarities at their pelvis (see Figs. 2–10 and text). General paleopathological findings from the Unterhautzenthall skeletons indicate rather high biomechanical strain, as obvious from frequent degenerative changes, asymmetrical body proportions, and (habitual) severe tooth wearing, found in males as well as in females. Furthermore, there was a relatively high occurrence of healed skull impression fractures here compared to other Bronze Age sites (Spannagl-Steiner et al. 2016). Archaeological results revealed that all women buried with babies had higher social index values than other women (SI average 60, vs. female average 54, general average 37).

References:

- Brůžek J. 2002: *A method for Visual Determination of Sex, Using the Human Hip Bone*. American Journal of Physical Anthropology 117, 157-168.
- Decrausaz S. 2014: *A morphometric analysis of parturition scarring on the human pelvic bone*. Victoria, BC. Canada: University of Victoria.
- Dihlmann W. 1987: *Gelenke-Wirbelverbindungen: Klinische Radiologie einschließlich Computertomographie - Diagnose, Differentialdiagnose*. 3. Auflage 82. Georg Thieme Verlag, Stuttgart - New York
- Fafila C.P. et al. 1998: *Variation in the appearance of the normal sacroiliac joint on pelvic CT*. Clinical Radiology 53, Issue 10, 742-746.
- Kelley M. 1979: *Parturition and pelvic changes*. American Journal of Physical Anthropology 51: 541-546.
- McFadden C. 2017: *Sex, parity and scars: A Meta-analytic review*. Journal of Forensic Sciences. DOI: 10.1111/1556-4029.13478
- Maass P. 2012: *The bony pelvis: scars of parturition and factors influencing their manifestation*. Cape Town, South Africa: University of Cape Town.
- Maass P. & Friedling L. 2016: *Scars of parturition? Influences beyond parity*. International Journal of Osteoarchaeology 26: 121-131.
- McArthur T.A. et al. 2016: *Parturition pit: the bony imprint of vaginal birth*. Skeletal Radiology 45, Issue 9, 1263-1267.
- Ruff C.B. et al. 2012: *Stature and Body Mass estimation from skeletal remains in the European Holocene*. American Journal of Physical Anthropology. DOI: 10.1002/ajpa.22087.
- Steckel R. et al. 2006: *Data Collection Codebook*. Global History of Health Project.
- Snodgrass J. & Galloway A. 2003: *Utility of dorsal pits and pubic tubercle height in parity assessment*. Journal of Forensic Science 48: 1226-1230.
- Spannagl-Steiner U.M. et al. 2016: *Accidental versus Intentional Head Injuries: A Comparative Study of Cranial Depressed Fractures*. PPA meeting, Moskau.
- Schemmer D., White P.G., Friedman L. 1995: *Radiology of the paragenoid sulcus*. Skeletal Radiol 24:205–209
- Perréard Lopreno G. & Brůžek J. 2010: *A well-evaluated preauricular groove on the hip bone is a very reliable sexual trait but not an indicator of parity*. Annual Meeting AAPA-Albuquerque.
- Williams P. L. et al. 1995: *Pelvic Mechanism*. In: Gray's Anatomy: The anatomical basis of medicine and surgery. Ed. 38, 678. Churchill Livingstone, New York - Edinburgh - London - Tokyo - Madrid and Melbourne

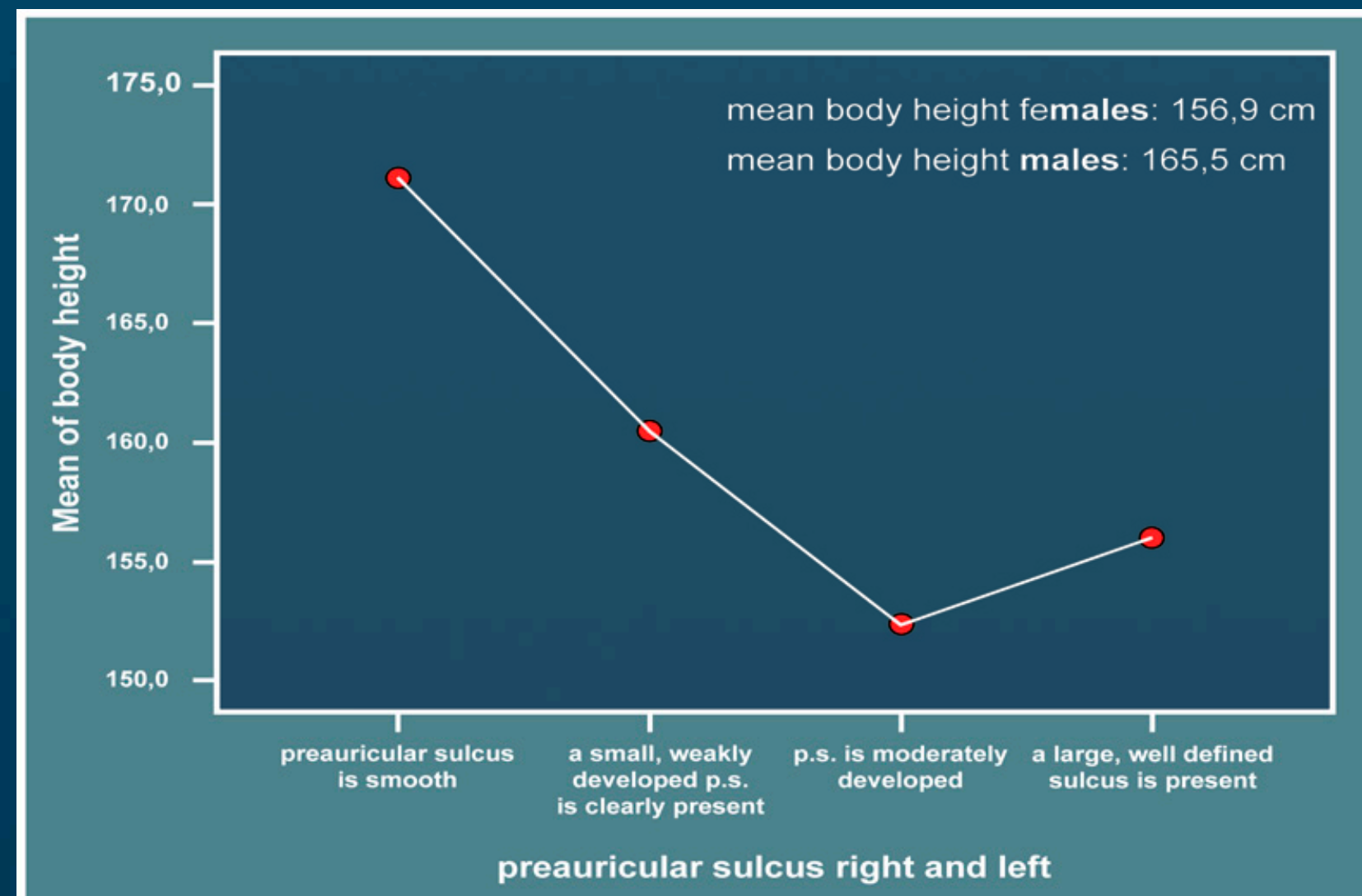


Fig. 1. Significant relationship for short stature and moderate to strong expressions of the preauricular sulcus in Unterhautzenthall.

The pictures above show pelvic changes in 3 females of different ages from Unterhautzenthall. The females from burials 93B and 109A show especially peculiar changes at the anterior-superior margin of the auricular facies. This location is typical for reparative ossifications, as there is the highest possible movement in this joint, and the capsule and the sacroiliac ligaments are prone to the highest strain there; bony extensions and arthroses at this site can be the result of overload damage of the joint capsule and cartilage (Dihlmann 1987). Moreover, due to the decreasing relaxin levels after childbirth the locking mechanism of the sacroiliac joint improves again, but this may occur in a position adopted during pregnancy; such sacroiliac "subluxation" occurs mostly in form of a backward rotation of the ilium relative to the sacrum, more frequently but not exclusively unilaterally (Williams et al. 1995).

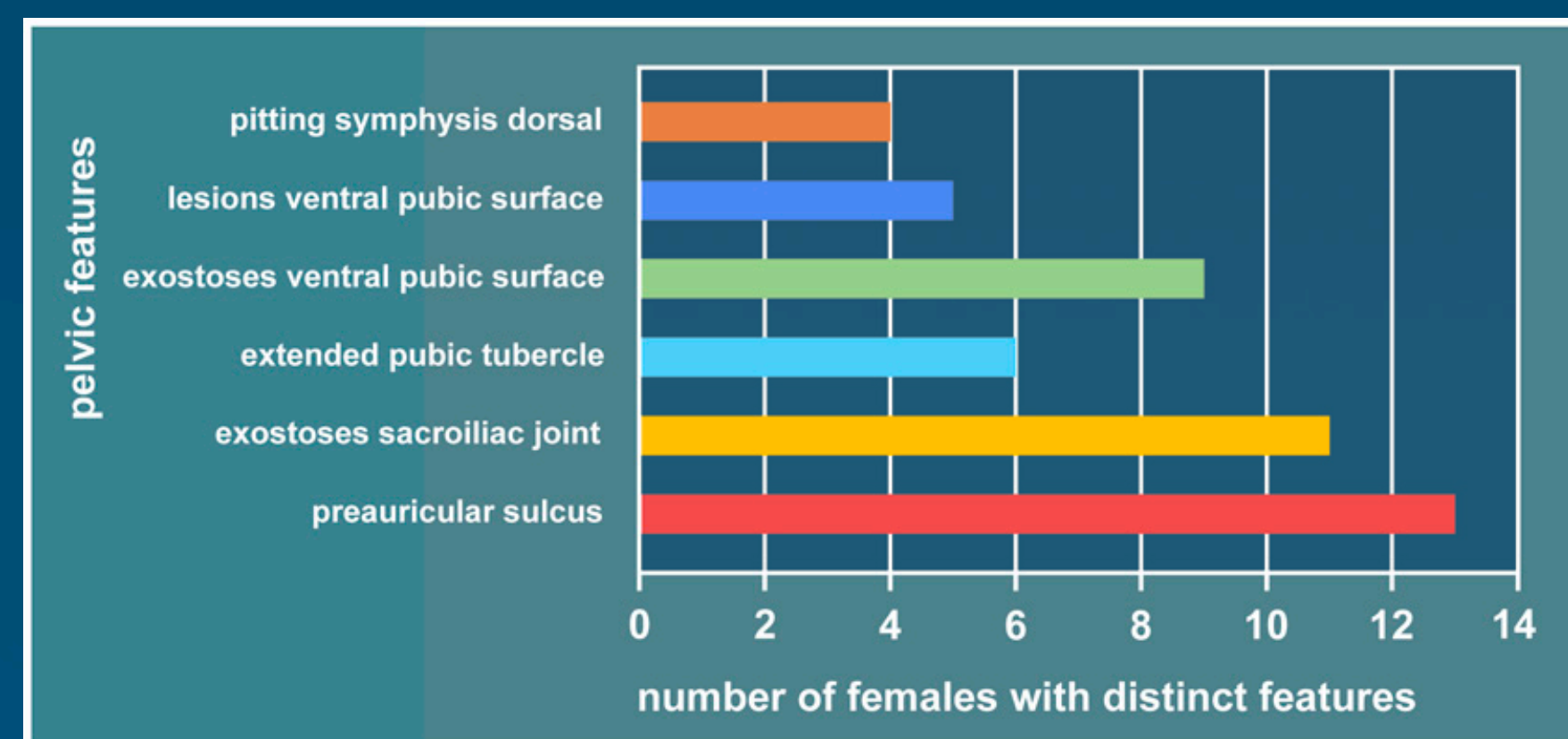


Fig. 9. Distribution of distinct pelvic features in the female sample (N=18).

Material and Methods

Systematic, bilateral examination of selected pelvic features is being carried out, including the preauricular surface (shape F/M after Brůžek 2002) and sulcus (stages 0–4 after Steckel et al., 2006), pitting at the dorsal pubic surface (stages 0–3, Stewart 1970), the extended pubic tubercle (stages 0–3, Snodgrass & Galloway 2003, Maass 2012). Exostoses at the margin of the sacroiliac joint, and exostoses and lesions at the ventral pubic surface are being assessed (present/not present). In addition, due to biomechanical reasons, selected muscle markings are recorded, and degenerative/congenital changes especially at the spine, the hip and the knee joints of the individuals are recorded (present/not present). Fractures at the hip bone and the sacral bone are assessed, as these may influence the occurrence of the features. Unspecific indicators of stress, selected inflammatory and endocranial changes, cranial/postcranial lesions, and nutritional deficiencies are noted for insight into socioeconomic conditions in the groups. For calculation, a maximal value was used to measure the strongest signal. Systematic photographs are taken of each feature at the pelvic and the sacral bones for comparison.

Discussion

Statistical results from the pilot study Unterhautzenthall show statistically significant associations between sex, body height, and the expression of the preauricular sulcus, as well as sacroiliac exostoses at the skeletons, which frequently occur together (Fig. 9), indicating potential error in using only one feature (cf. Kelley 1979). In a CT study, Fafila et al. (1998) showed that exostoses occur at the sacroiliac joint in females with a higher frequency only in multipares. Including the peculiarities described here (Figs 2–10), the single individual features may result in a pattern over and between larger samples from additional cemeteries. Apart from the archaeological assignments of a higher SI for females buried with children, the archaeological and anthropological results do not indicate a higher social status of this group. Of course, some of the changes may be attributed to age (mean age in both sexes ~37 years). However, the described peculiarities (among others) were not found in males.

Recent papers were able to show statistical relationships between some of the observed pelvic changes and body size, pelvic size, pelvic shape, age, weight bearing strain, and joint flexibility. However, more severe scarring was found only in females and an intensification of the features through birth events is conceded (Decrausaz 2014, Maass & Friedling 2016, Schemmer 1995). For comparative reasons, a clear definition of the observed features and congruent methods would be essential. A recent meta-analytic review of the relevant literature (McFadden & Oxenham 2017) reveals only a weak relationship between dorsal pubic pitting and parity, but believes it is a product of the moderate relationship with sex. Regrettably, the authors did not include the radiological work of McArthur (2016) who found a statistically significant relationship between dorsal pits and prior vaginal birth even after adjusting for race and age. No males had pits. The distribution of preauricular sulci, however, was not statistically different among para and nullipara (but small number of the latter). In a sample of known parity history from Switzerland, Perréard Lopreno and Brůžek (2010) found true preauricular grooves in both nulliparous and multiparous females, concluding it is a good indicator of sex. Unfortunately, they do not give information on body proportions in their conference paper. The role of the extended pubic tubercle remains unclear (Snodgrass & Galloway 2003, Maass and Friedling 2016). Summed up, some of the features are more severely expressed and more frequent in females, but the question why remains to be resolved. In this comparative analysis, we are trying to find patterns at the pelvis and surrounding skeletal elements, which frequently accompany the so-called "parity features". While the authors are aware of the methodological problems, an interdisciplinary, holistic approach seems the only way it can be attempted.

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