In Centro

Collected Papers
Volume III

Time

Editors:
Guy D. Stiebel
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רשות העתיקות
ISRAEL ANTIQUITIES AUTHORITY
TEL AVIV UNIVERSITY
Bar-Ilan University
אוניברסיטת בר־אילן

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Collected Papers
Volume III

Central Region

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The Sonia and Marco Nadler Institute of Archaeology
The Jacob M. Alkow Department of Archaeology and Ancient Near Eastern Cultures
The Chaim Rosenberg School of Jewish Studies and Archaeology
The Lester and Sally Entin Faculty of Humanities

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Contents

Insights into the Contribution of Radiocarbon Dating in Reconstructing Jerusalem's Past: The Early Bronze Age Settlement of Jerusalem

Johanna Regev, Joe Uziel, Yuval Gadot, Helena Roth, Eugenia Mintz, Lior Regev and Elisabetta Boaretto

Less than a decade ago, the dearth of radiocarbon dates from Jerusalem stood in stark contrast to the plethora of excavations that had been conducted in the city's ancient core. Although earlier excavations were not familiar with the application of absolute dating, later excavations still relied solely on relative dating, primarily based on pottery typology. The extensive use of radiocarbon dating in excavations throughout Israel, beginning in the 1990s (e.g., Sharon, Gilboa and Boaretto 2007) and increasing in the new millennium (see, e.g., Mazar and Carmi 2001; Boaretto *et al*. 2005; Boaretto 2009; Finkelstein and Piazetsky 2006; 2015), seemed to have passed over Jerusalem. This situation has been largely corrected due to the project initiated by the authors,[1] which aimed at providing a complete radiocarbon framework for the reconstruction of the history of settlement at the site, including dating all layers of human activity, as well as important structures and elements that reflect on the city's character in various periods. The project approached

* **Johanna Regev, Eugenia Mintz, Lior Regev** and **Elisabetta Boaretto**: The Weizmann Institute of Science, Rehovot; **Joe Uziel**: Israel Antiquities Authority; **Yuval Gadot** and **Helena Roth**: Tel Aviv University

1 The absolute dating of Jerusalem's archaeological layers was funded by the Israel Science Foundation (Grant No. 1873/17).

the dating of the archaeological elements as a collaboration between field archaeologists and radiocarbon specialists, working together in real time, at the excavation site in order to properly define the sampling methods and the related stratigraphic sequence. The samples taken were coupled with microarchaeological analysis, in order to help the characterization of the context. The radiocarbon analysis was undertaken together with standard archaeological methodology (pottery analysis, numismatics, etc.), in order to use all relevant data when dating a layer. The samples were analyzed in the Dangoor Research Accelerator Mass Spectrometer D-REAMS Laboratory at the Weizmann Institute of Science, after being collected in the various areas of excavation.[2] By applying stratigraphic analysis, as well as pottery, coin and glass dating, models were constructed that enabled a much higher resolution in the dates attributed to various features.

To date, 196 radiocarbon dates from Jerusalem have been published (Regev *et al*. 2017c; 2020; 2021; 2023). Although we continue to publish more of the samples collected, the published data have brought Jerusalem to the forefront of radiocarbon research in Israel, greatly impacting the methodology applied to excavations in Jerusalem as a whole, with radiocarbon field specialists more actively integrated into the various excavations. The current paper presents more of this data, particularly results dating to the Early Bronze Age. These dates further the discussion on the EB I–II transition. While past research suggested a more direct correlation between the transition of sub-divisions of the Early Bronze Age and the transitions between these period (e.g., Braun 2011), the radiocarbon dating of numerous sites in the southern Levant has shown that these transitions, and in particular the EB I–II transition are much more gradual, occurring over a longer period of time

2 The radiocarbon research was supported by the Exilarch Foundation for the Dangoor Research Accelerator Mass Spectrometer (D-REAMS) Laboratory. We wish to thank the Kimmel Center for Archaeological Science and George Schwartzman Fund for the laboratory and funding support for the material analysis. E. Boaretto is the incumbent of the Dangoor Professorial Chair of Archaeological Sciences at the Weizmann Institute of Science, Rehovot.

at different sites and in different parts of the region (Regev *et al*. 2012). The current paper provides additional data to the understanding of the variations of this transitional period, particularly for the hill country.

The Early Bronze Age in Jerusalem

The earliest human activity in the ancient site of Jerusalem, located on the Southeastern Hill, goes back to the Epipaleolithic period, some 15,000 years BP, as evidenced by stray finds found in the vicinity of the spring (Marder and Khalaly 2004). Such activity—with no associated architecture—continued at the site until the Early Bronze Age, to which the first structures and secure burial contexts can be attributed. Of most significance are two particular

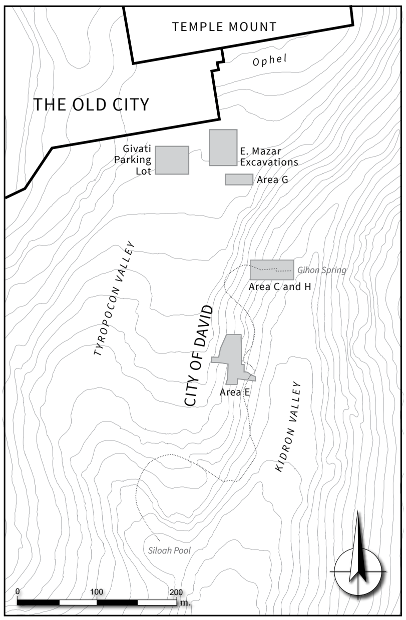

Fig. 1: Map of the City of David, showing the location of areas yielding Early Bronze Age remains (by Joe Uziel)

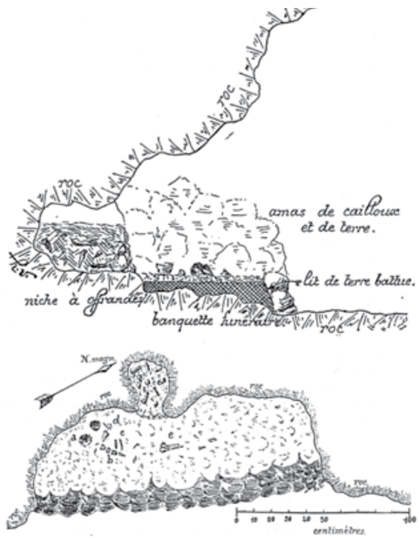

Fig. 2: Plan and section of Early Bronze Age burials exposed by M. Parker (Vincent 1911)

locales (Fig. 1). The first are two Early Bronze I burials, excavated in the early 20th century by M. Parker and published by L.H. Vincent (1911) (Fig. 2). While the excavation as a whole was not very scientific, a significant assemblage of vessels was uncovered and published, providing a secure chronocultural horizon for the burials in the EB I (see Maeir, Yellin and Goren 1992), which can be radiocarbon dated in the Southern Levant between 3700–3200/3100 BCE (Regev *et al*. 2012; 2020).

The second location includes buildings on the lower eastern slopes, uncovered in Y. Shiloh's excavations of Area E (Fig. 3). Area E was extensively excavated in the 1970s and 1980s by Shiloh. These excavations exposed two Early Bronze Age strata: 20 and 19. The main structure was composed of three

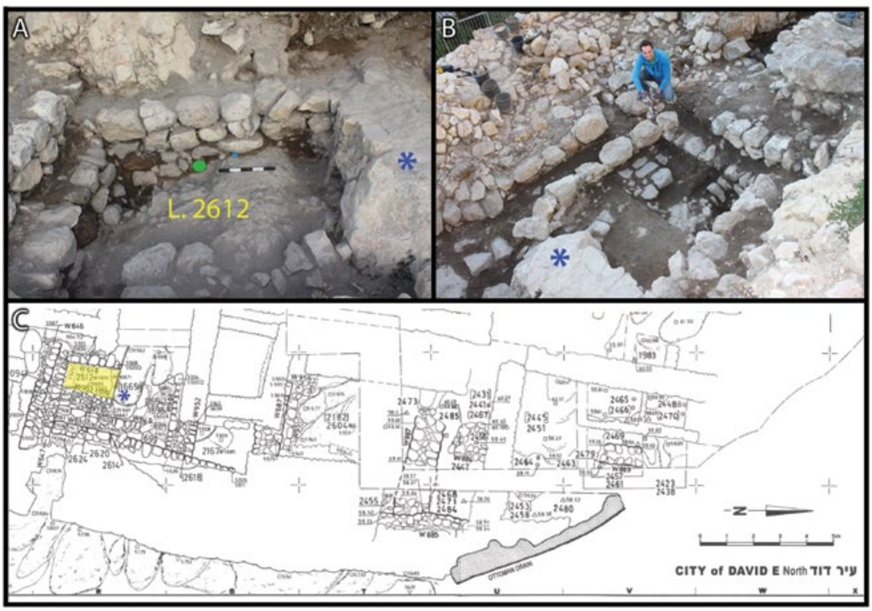

Fig. 3: Area E, EB broadroom house (Shiloh's L.2612); A) after cleaning during the 2016 excavations, view to the west; the green circle marks the location of the ^{14}C samples below W648; the blue asterisk marks a large bedrock slab inside the room, appearing in all three images; B) view to the east of the same room; the MB city wall is seen in the upper left (photos by Johanna Regev); C) Shiloh's drawing of Strata 19–20 (after De Groot 2012, Plan 52b); the yellow area marks the area seen in A

rooms (De Groot and Bernick-Greenberg 2012: 123–127). While Shiloh (1984: 25) originally dated the construction date to the EB IB, linking them with the burials, the final report suggests that the original date was erroneous as no pottery that could be exclusively dated to the EB I was found in direct relation to the structures. As such, Greenberg suggested that the assemblage from beneath the structures should be dated to the EB II, placing the establishment of the building in this period. Furthermore, the finds from within the structures indicate use of the buildings in the EB II and the early stages of the EB III (De Groot 2012: 144; Greenberg 2012: 308). It is important to note that the date ranges provided by Shiloh, De Groot and Greenberg all conform to the low chronology that was widely accepted, prior to the recent radiometric study of many Early Bronze Age sites throughout the country, which has shown that in fact, the dating of the Early Bronze Age, including its internal division, is much earlier than previously thought (see Regev *et al*. 2012; Table 1).

Recent excavations in Area E (Regev *et al*. 2021) provided the opportunity to more accurately date the structures in Area E,[3] particularly in light of the new chronological scheme of the Early Bronze Age as a whole (see Regev *et al*. 2012). In the current study, the authors initiated a renewed excavation aimed at recovering material for a radiocarbon-dated absolute chronology from all the key contexts that could be correlated with the Shiloh's stratigraphy. The excavation locations chosen for this purpose were mainly located within baulks which remained from the previous excavations and, as in the case presented in this article, re-cleaning of a previously excavated building, in the hope of locating remains that are still *in situ*.

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3 The excavations of the baulks in Area E were directed by Yuval Gadot with the help of Helena Roth (license Nos. G-62/2015, G-24/2016 and G-11/2017). The project was conducted within the confines of the City of David National Park. The excavations were conducted in cooperation with Macquarie University (Sydney, Australia, 2015), University of Bonn, University of Heidelberg, the Christian Theological Academy in Warsaw (2016), Charles University, Prague, and Zurich University (2017). The work was made possible thanks to the generous contribution of Dr. Holger Aulepp. The authors wish to extend their thanks to Prof. Manfred Oeming, the late Prof. Axel Graupner, Prof. Gill Davis, Prof. Martin Prudký, Prof. Filip Čapek, Prof. Jakub Slawik and Dr. Florian Oepping. We wish to thank all the support provided by the Israel Antiquities Authority and Ir David Foundation (ELAD).

Table 1: Early Bronze Age radiocarbon samples from Jerusalem

Area	RT No.	Libby age	Archaeological context	Locus, basket, type	Cal 1s [BCE]	Cal 2s [BCE]	δ13C [‰]
Area E	RTD 10219	4468 ±21	0–10 cm above bedrock, and below a layer of small stones and pottery. This layer is 10 cm under the wall of room L.2612 (Shiloh locus).	L.3070, B.130646, olive pit/fruit	3326(49.8%)3230 3182(11.0%)3156 3109(7.5%)3092	3334(55.3%)3212 3192(32.2%)3082 3060(8.0%)3028	-21.53
	RTD 10220	4513 ±28		L.3070, B.130646, cereal	3346(11.8%)3320 3237(29.5%)3176 3160(27.0%)3106	3356(30.7%)3262 3249(64.8%)3100	-23.67
	RTD 8776	4473 ±33	10 cm above bedrock, from within the layer of small stones and pottery. 10 cm under the wall of room L.2612 (Shiloh locus).	L.3070, B.130646/7, olive pit	3331(44.4%)3216 3188(12.9%)3152 3126(11.0%)3092	3342(86.9%)3076 3064(8.5%)3026	-21.25
	R_ combine L.3070	4482 ±14	Under wall of room L.2612.	–	3328(35.8%)3262 3250(13.3%)3222 3182(14.3%)3155 3110(5.0%)3100	3336(58.8%)3212 3193(36.7%)3094	
Area U	RTD 9607	4426 ±19	Room 17130 Gray layer directly above bedrock, under a layer of crushed pottery	L.17130, B.172128.4, cf. olive pit	3097(68.3%)3018	3315(2.0%)3296 3286(8.7%)3240 3105(73.5%)3005 2990(11.2%)2928	-20.37
Spring Tower	RTD 7901	4025 ±26	Under a stone in northern part of the spring tower, 2nd layer from top with charcoal flecks	L.14700, B.147000 and B.147005, cereal, olive pit	2574(16.4%)2556 2543(51.8%)2488	2621(4.6%)2600 2584(90.8%)2469	-18.37

Fig. 4: Area E, ^{14}C sample locations; A) W648 in L2612; the red asterisk marks the same stone in all four images under which the samples were collected; B) the layer of pottery and small stones, extending roughly 10 cm below the lowest course of W648 stones, is above the dotted line; C) detailed location of the three dated samples prior to removal of B130647; RTD 8776 is from the pottery layer marked in B, and RTDs 10219,20 are below this layer; D) the same location, after the removal of B130647, revealed a gray compacted sediment with a cluster of charred seeds (photos by Johanna Regev)

Methods

All samples were collected in the field by the authors, aimed specifically for chronology building by radiocarbon dating, in order to link the contexts securely to the feature dated. The screening for preservation and quality of the material for radiocarbon dating, as well as the pre-treatment process toward dating, was tailored according to the type of material and sample size, as presented in previous studies (Boaretto 2009; 2015; Regev *et al*. 2014; 2020). After careful separation of the contaminants from the original material, the samples were graphitized and measured at the D-REAMS laboratory at the Weizmann Institute of Science (Regev *et al*. 2017). Radiocarbon ages (Libby Age) are reported in conventional radiocarbon years (before present = 1950) in accordance with international convention (Stuiver and Polach 1977). All calculated ^{14}C ages have been corrected for fractionation so the results are equivalent to the standard $\delta^{13}C$ value of -25‰ (wood). Calibrated ages in calendar years have been obtained from the calibration tables of IntCal20 (Reimer *et al.* 2020) by means of OxCal v. 4.4.4 (Bronk Ramsey 2009). The charred botanical remains were identified using binocular microscope SMZ-800N (Nikon). The context sediments were characterized using FTIR (Fourier Transform Infrared Analysis) analysis with Nicolet iS5 (Thermo) FTIR instrument at 4 cm^{-1} resolution. The spectra could be used to identify the presence of anthropogenic substances, such as burnt clay (Berna *et al*. 2007), phosphate (Weiner 2010) and disordered calcite (Regev *et al*. 2010).

Results

During a small-scale excavation in the spring of 2016, we cleaned room L2612, one of the two broad rooms excavated by Shiloh. The bedrock in the room was not level, and in some parts the walls were built directly on bedrock, while in other parts, a sediment layer of up to 30 cm lay between the bedrock and the lowest course of stones of the walls. In that sediment layer, 5–10 cm beneath the stones of the wall, a horizontal line of pottery sherds and small stones could be traced in the well-cleaned section (Figs. 3–4). Based on the FTIR spectra (Weiner 2010), the mineral composition of the sediment above and below the pottery horizon is very similar, where both have a dominant presence of clay rather than calcite. The calcite crystalline order is that of limestone, based on the grinding curves method (Regev *et al*. 2010). The horizon beneath the pottery was grayish in color, compacted, and had a slightly higher presence of phosphate, and the clay is slightly heat altered. We found a cluster of seven seeds in the small amount of sediment that could be collected from this sediment and dated samples RTD 10220 (cereal) and RTD 10219 (olive or fruit pit). Sample RTD-8776 (olive pit) originated from the sediment within the layer of pottery and small stones. The

Fig. 5: Area U, location of sample RTD 9607; several seeds from a thin gray layer directly above bedrock and under a layer of Iron Age vessels (photo by Johanna Regev)

three measurements are similar and give a R-combined result of 4482±15 ^{14}C year BP, calibrating within 68.3% probability between 3330–3100 BCE. This broad calibrated range of dates is due to the calibration plateau occurring at this time. This range correlates with the late EB IB horizon in Beth Yeraḥ, which includes "Grain-wash" decorated pottery, but also with the early horizon of EB II, where the repertoire already includes as hallmarks the "South Levantine Metallic Ware" and Golan cooking pots (Greenberg and Porat 1996; 2014). These chrono-cultural horizons have identical calibrated ranges. In Tel Beth Yeraḥ, due to many dates in stratigraphy, it was possible to model the transition date from the late EB IB to the early EB II between 3220–3100 cal BCE (Regev *et al*. 2020). In Jerusalem, no stratigraphy could be obtained in the previously excavated room without remaining baulks, thus leaving the calibrated range long. Similarly, in Tel Yarmuth the final EB IB and early EB II have some overlap in the calibrated ranges. There the transition between the EB IB and EB II was modeled a century later than in Tel Beth Yeraḥ, between 3100–3000 BCE (Regev *et al*. 2012). As noted before (De Groot 2012), the architecture in Area E is similar to the broad room houses widely excavated in Tel Arad (Amiran and Ilan 1996) in Stratum III and II. The end of the early EB II, Stratum III houses in Arad is dated between 2910–2900 BCE. Since our dates originate underneath the room walls, from two layers with identical dates, and they are most likely to present the time immediately preceding the construction of the rooms, they fit very well the overall scenario of building time at the late EB IB or early EB II. As the pottery inside the room consist of slightly later pottery, from the EB II and EB IIIA (including some Khirbet Kerak sherds), the data reasonably suggests a lengthy Early Bronze Age occupation in the southeastern slopes of the City of David of roughly 300 years.

Another radiocarbon date, pointing to a prolonged Early Bronze Age occupation, came from Area U, Room 17130, an olive pit sampled directly above bedrock as RTD-9607, underneath rubble of the 8th-century BCE earthquake (Fig. 5; Uziel and Chalaf 2021; Regev *et al*. 2021; 2023). This date is slightly later than those from Area E, within a clear EB II cultural setting, having a calibrated range between 3100–3020 cal BCE, correlating with Arad Str III and the early part of the EB II at Beth Yeraḥ (Regev *et al*. 2017; 2020).

It is important to note a third context, where another, most likely Early Bronze Age, date was retrieved. The samples taken from underneath the Spring Tower (Regev *et al*. 2017c) yielded a date from roughly 2500 cal BCE. However, the date obtained (RTD-7901) consisted of two fragments, combined together from a cereal and an olive pit. Therefore, it may indicate a late EB III date, or alternatively mixed material from the Early and Middle Bronze Ages. As such, it is clear that there was activity in the vicinity of the spring either from 2500 BCE or earlier. Despite the limitations in using this date in the current research, the retrieval of the dates beneath the spring tower helped determine the methodology of the entire project, which strictly dated single samples from that point onward.

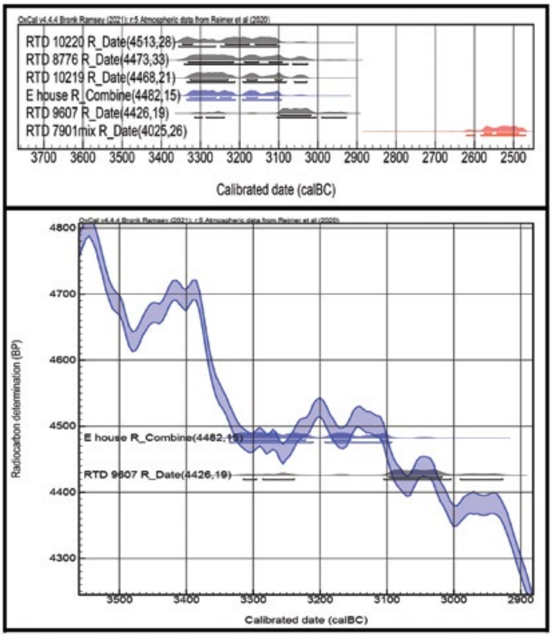

Fig. 6: ^{14}C dating results; top: calibrated probability distributions of the five EB dates; the combined result of the three samples from Area E is in blue, and the result of the mixed sample from the Spring Tower is in red; bottom: the probability distributions of the combined result and the date from Area U on the calibration curve, showing the fluctuating nature of the curve in this region

Discussion

Although less extensive than the results from other periods, the Early Bronze Age ^{14}C results provide another indication of the settlement of Jerusalem in this period. Although earlier artifacts were collected in the area of the eastern slopes of the City of David, spanning the period between the Epipaleolithic period and the Chalcolithic period, the earliest architectural remains and burials found at the site are securely attributed to the Early Bronze Age. It is likely that the familiarity with the natural spring, i.e., the Gihon Spring, which emanates from a cave at the base on the Southeastern Hill, led to the eventual settlement along the hill's slopes in the late fourth millennium BCE. The settlement seems to have been limited to the eastern slopes, only growing towards the upper parts of the mound in later periods. Interestingly, the settlement was established in the late EB I or early EB II, as attested to by the ceramic evidence as well as the radiocarbon dating (Fig. 6). The ceramic analysis led Greenberg (2012) to conclude that although Shiloh (1984) had suggested dating the construction to the EB I, the latest pottery beneath the building dated to the EB II, setting the date of construction in this period. Although it is difficult to determine the more precise dating of the settlement, due to the lack of a dense stratigraphic sequence, it is possible that the dates retrieved signify that the date of construction may reflect a period of transition between the EB IB and EB II. The additional dates from Area U indicate that the human activity extended further to the north from Area E, towards the area of the spring, although these dates were not retrieved from architectural contexts. It appears that the settlement continued to utilize the spring well into the EB II. To date, no clear radiocarbon evidence for EB III occupation has been discovered, although this may be due to chance and the meager contexts available for sampling during our study. If the settlement did continue into this portion of the Early Bronze Age, it is not clear what the nature and character of the site was, although it is difficult to imagine that it would have evolved much. If the site was abandoned and did not continue into the EB III, the reasons for the abandonment cannot be determined with any sense of certainty, although it is possible that the residents of the village relocated to one of the fortified towns in the hill country that flourished in the EB II–III (e.g., Hebron, ʿAi, Jericho). Regardless, it would be centuries before the site of Jerusalem would be occupied once again, in the Middle Bronze Age.

Conclusions

The current paper presents a small venue into another new, previously undated, period by radiocarbon in Jerusalem. The use of absolute dating has changed the way in which we approach fieldwork in the vicinity of the ancient core of Jerusalem. Whereas in the past, layers, strata and architectural elements were dated according to artifact typology of material culture—particularly pottery—recent excavations have integrated ^{14}C dating, alongside existing methods, in order to better date each feature using all available evidence. By integrating stratigraphy and pottery, the modeled ^{14}C dates may be greatly narrowed down and provide precise dates that can be linked to specific moments in the city's history. At a minimum, the radiocarbon dates corroborate other dating methods, providing additional evidence for the dating of strata. At times, as in relation to the Early Bronze Age in Jerusalem, the radiocarbon dates can pinpoint times of site occupation and allow correlation with sites that have more precisely modeled ^{14}C chronologies based on multiple stratigraphic contexts. The occupation dated in Jerusalem is contemporaneous to EB IB late and early EB II as dated in Tel Beth Yeraḥ, Tel Yarmuth and Tel Arad. Once widely and carefully applied, radiocarbon dating can revolutionize the understanding of timing of events, cultural changes and regional processes. In all these cases, there is no doubt that the application of ^{14}C in the field has begun to revolutionize the archaeology of Jerusalem.

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