

# **Marbres et autres roches de la Méditerranée antique : études interdisciplinaires**

**Interdisciplinary Studies on Mediterranean  
Ancient Marble and Stones**

Sous la direction de Philippe Jockey



ΛΕΥΚΟΣ ΛΙΘΟΣ

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## The *Marmor* of Tarraco or Santa Tecla Stone (Tarragona, Spain)

Santa Tecla stone or *marmor* of Tarraco is one of the most distinctive local stones used for decorative purposes during Roman times in the northeast corner of the Iberian Peninsula (Fig. 1). It is a usually yellow limestone that was exploited at Tarragona until very recently. Even though other stones were locally exploited in Tarragona's environs in ancient times, Santa Tecla stone was by far the most valued, widespread and prestigious. Its current name, Santa Tecla stone, comes from the fact that chapel dedicated to Santa Tecla at the cathedral of Tarragona is completely panelled with a combination of several varieties of this limestone. Little is known about the name given to this stone by the Romans, since it was not enough prized and distributed to be mentioned by the classical sources. Nevertheless, the epigraphic record provides evidence to suggest it was considered a *marmor*. There is a mention on two Santa Tecla stone pedestals dedicated to Lucius Pedanius Euphro<sup>1</sup> that "*basis lapidea aere clusa vetustate erat corrupta*" were replaced by *marmoreae* ones. Another epigraph that supports this assumption is the inscription that reads "*titulum sulcato marmore ferro*" in which the term *marmor* definitely refers to Santa Tecla stone.<sup>2</sup>

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### Geological Setting

The local geology of Tarragona consists of Mesozoic materials of Triassic, Jurassic and Cretaceous age. All these geological levels are covered by formations of the Neogene. This area is located in the easternmost limit of the Iberian Coastal Range and it has only suffered a slight tectonic deformation. Thus, the sedimentary layers have a sub-horizontal position; small folds and some fractures can be observed. The earlier sediments that crop out are from the upper Albian. Santa Tecla limestone belongs to the upper Cenomanian, and forms a 6-km-long and 1-km-wide, narrow stretch of land. It is a compact limestone, biomicrite and sparite, more or less dolomitized and affected by karstic activity. There are many colour varieties with predominance of the yellow-pink-red tonalities.

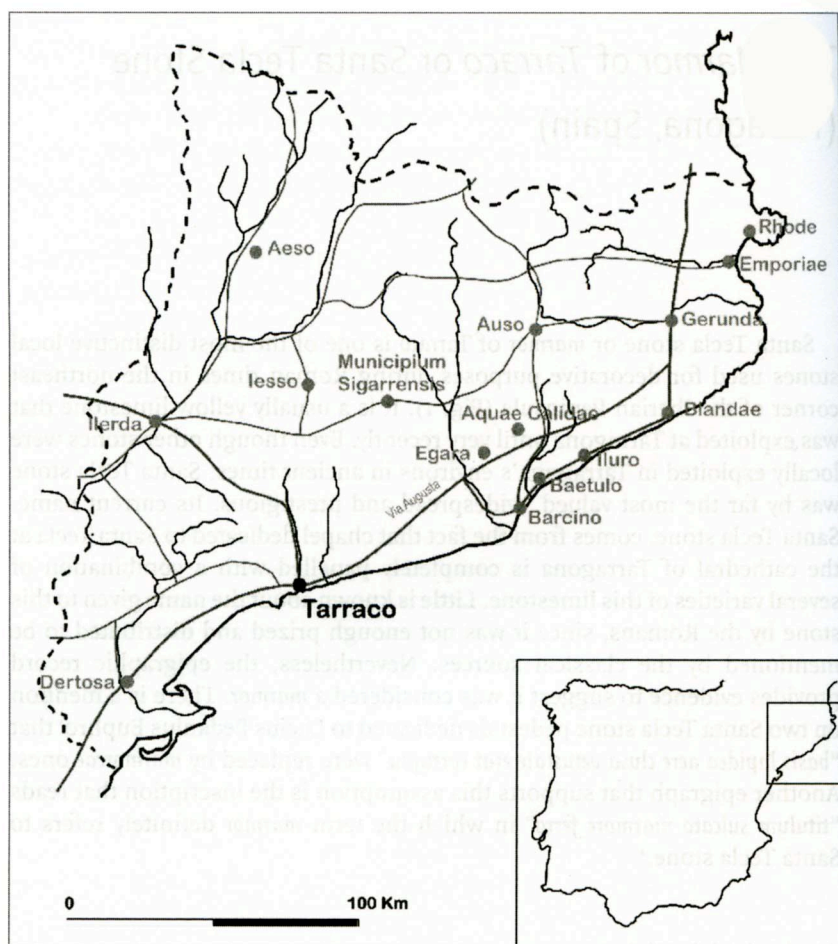


Fig. 1 – Schematic map showing the location of Tarraco and other Roman towns of the northeast corner of the Iberian Peninsula.



## Petrographic Study

Santa Tecla limestone can be classified as a packstone<sup>3</sup> or according to Folk<sup>4</sup> as a biomicrite. However, diagenetic processes have transformed the original texture turning it into a crystalline limestone. Alternatively, the rock name could range from a microsparstone (with crystals  $< 10 \mu\text{m}$ ) to a sparstone (with crystals  $> 10 \mu\text{m}$ ) as it shows micritic zones with irregular areas of sparite.<sup>5</sup> Although no fossils with the original shells are preserved, calcite fillings (sparite) of shell moulds can be encountered. These are bivalves (lamellibranchia) with its usual curved shape (Fig. 2 - Pl. I.5).

Also, there are plates from crinoids that develop sintaxial growths of sparite. In some areas the calcite cement can be identified among round-shaped micrite peloids. Sinusoidal cracks with drusy fillings of calcite (sparite) can be observed. These correspond to epidiagenetic processes of crack filling linked to the karstic system. The development of stylolites with iron oxide accumulations is recognizable as a late diagenetic process, since it affects the remaining structures.

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## Cathodoluminescence Characterization

The areas with higher rate of recrystallization (sparite) are the ones that exhibit luminescence. The bright areas with yellow-orange tones are distributed along the limits of the calcite crystals. These correspond to areas containing elements that activate the luminescence ( $\text{Mn}^{2+}$ ) (Fig. 3 - Pl. I.5; Fig. 4 - Pl. I.5).

For some crystals, a gradual change of the luminescence is observed from the surface of the calcite crystal to its centre, revealing its compositional variation during its growth. The areas where we observe the original texture (micrite) do not show luminescence. The observed cathodoluminescence colours are:

- purple back with orange calcite micro veins;
- dark in the bioclastic cavities (drusy calcite);
- dull luminescence in micritic shells;
- sparry cement: zonation dark/bright/dull luminescence.

## The Quarries

The outcrops that have been traditionally exploited are located in the area between Nostra Senyora de Loreto chapel, commonly known as El Llorito, and Nostra Senyora de la Salut chapel, on a lot northeast from Tarragona known as La Bulladera. Up to ten quarry sites were initially identified, but only eight of them still remain untouched by the quarrying currently in progress at the area (Fig. 5 - Pl. I.6).<sup>6</sup> Yet only El Llorito quarry sites 4 and 10 preserve traces of traditional

quarrying methods (e.g. smooth vertical walls, trenches to delimit blocks and wedge sockets), and solely El Llorito 4, a small quarry site on the east slope of the low hill facing Tarragona, could date back from ancient times.<sup>7</sup> The other sites present traces of very recent use; the continuous usage of these geological layers, which are being exploited intensively since modern times, leads to the irremediable loss of any evidence of possible quarrying practices during Roman times.

In any case, any one of these sites can perfectly illustrate the wide range of stone varieties that can be found in this relatively small area. The golden-yellow-colored varieties were most valued, even though they were not too large. They appear alongside the pinkish portasanta-like varieties, and the Cretaceous limestones which were used in Roman times, but valued less than the Santa Tecla stone.

### Similarities

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From its macroscopic and external appearance, the Santa Tecla stone (Figs. 6 & 7 - Pl. I.5; Fig. 8 - Pl. I.7) could be mistaken for other varieties used during the Roman period, namely Portasanta (marmor Chium) from Chios, Greece (Fig. 9 - Pl. I.5) and Buixarró stone from Xàtiva (ancient Saetabis), Spain (Fig. 10 - Pl. I.5).

Portasanta presents rosy shades, whereas Buixarró stone is both pinkish and yellowish. They can be easily distinguished through microscope observation.

Portasanta limestone is a breccia with a calcareous matrix (of micritic size, from 1/16 to 1/256 Ø mm). The material has been fractured, and later the cracks were filled by secondary calcite (sparite) crystals, more or less idiomorphic, and growing perpendicular to the cracks' edges. Sometimes, the cracks were filled with micas and quartz grains introduced by diagenetic dynamism. Thus, several mica layers (muscovite and biotite) can be observed in the matrix, as well as quartz grains with re-dissolution (round-shaped surfaces and ameboidal shapes). Occasionally, the cracks were filled uniquely with materials of detrital origin, such as stylolites mineralised by iron oxide.

Buixarró stone is also a highly fractured limestone, and can even be considered a breccia with heterometric fragments of fossils. These are difficult to identify due to the intense diagenetic processes. This stone can be classified as a bioclastic packstone<sup>8</sup> or an unsorted biosparite.<sup>9</sup> Despite the diagenetic modifications, in the varieties not classified as a breccia, the fossil structures are much more common than in the Santa Tecla stone. Not only the moulds but also the shells are recognizable.

There is a great variety of skeletal grains: bivalves, gastropods, calcareous algae, echinoderms, and microforaminifera (especially orbitoids, among others). Also, the presence of a thin diagenetic micritization surrounding most shells is common. It is caused by multiple microboring and subsequent infilling with microcrystalline calcite cement. Micritic peloids are abundant.



Sometimes Buixcarró stone is a brecciated stone, and also iron oxides (in stylolites) are as common as they are in Santa Tecla stone. In general terms, Buixcarró stone shows lower luminescence than Santa Tecla one.

In the most brecciated varieties, the diagenetic processes have affected the general texture in such a way that its appearance is similar to the Santa Tecla stone. However, the transformation degree is much higher, and sparry components predominate over the micritic ones. The iron oxides have impregnated the first-generation crystal faces formed within the rock cracks. In a second stage, the cracks were filled up with calcite developed as idiomorphic polygonal grains.

### Santa Tecla Stone Use in Roman Times

Nonetheless, the evidence of Roman use of Santa Tecla stone is abundant in the archaeological record. As any other material, no matter how fine and valued it is, it is also locally used for minor purposes when abundant in its own source area. Santa Tecla stone was therefore employed as raw material for a wide range of purposes at Tarraco.

One of the first uses of any type of stone has always been as building material, and Santa Tecla stone is no exception. However, except for irregular small chunks included in *opus caementicium* masses,<sup>10</sup> it was mainly intended for visible architectural elements, such as bases, thresholds, skirting boards, column shafts, architraves and revetments. There are also examples of cylindrical cornices<sup>11</sup> and bench fragments.<sup>12</sup> On the other hand, Santa Tecla stone was also used to produce an extensive assortment of epigraphic monuments such as funerary stelae,<sup>13</sup> pedestals, altars,<sup>14</sup> commemorative stones or plaques,<sup>15</sup> and even sarcophagi.<sup>16</sup> Among them, honorific parallelepipedal pedestals stand out as the most abundant type, as numerous examples have been found not only at Tarragona but also at many other cities of the *conventus Tarraconensis*. The study of these monuments leads to the identification of a workshop at Tarraco, which produced a great number of semi-manufactured and completely finished pedestals subsequently to be distributed.<sup>17</sup> The case of *Barcino* is demonstrative: 11 out of 12 molded, parallelepipedic pedestals dedicated to *Lucius Licinius Secundo*, a powerful freedman of the consul *Licinius Sura*, friend and counsellor of Emperor Trajan, are made of Santa Tecla stone.<sup>18</sup>

Santa Tecla stone was largely used at *opus sectile* pavements, or simply as decorative *crustae* for wall veneers or flooring slabs. They tend to be relatively thick, and usually have quite a rough internal surface. Several *villae* of *conventus Tarraconensis* were embellished with Santa Tecla stone revetment slabs alongside the most prized imported *marmora*. Especially in the Tarraco hinterland, Santa Tecla was the predominant decorative stone (e.g. *Can Modolell*<sup>19</sup> and *Can Xammar*, in the area of *Iluro*, north of *Barcino*, but in particular at *Els Antigons* and *Els Munts*, near Tarraco).<sup>20</sup>

As it is not readily suitable for carving, decoration motifs on Santa Tecla stone are usually rather unelaborated. Moldings are found occasionally on architectural elements, while other simple motifs are more common on sarcophagi. By way of illustrative examples, we can mention some sarcophagi<sup>21</sup> with striations. Worth mentioning is also the case of some more elaborated sarcophagi found at Tarraco. They were at first considered products of this town's workshop; however, subsequent petrological analyses demonstrate that they are in fact made of 'kadel' stone (from near Carthago, in Tunis) and that, hence, they were imported from the north African workshops that during late imperial times had a strong presence on the necropolis of Tarraco.<sup>22</sup>

So far, we have no notice of sculptures made with Santa Tecla stone.

### Santa Tecla Stone Diffusion

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Thanks to the identification of architectonic elements, slabs, epigraphs or other objects made of Santa Tecla stone, it is clear that this material went beyond merely local distribution. Indeed, its geographic diffusion covers most of the northeast sector of *conventus Tarraconensis*, but hypothetic cases of possible Santa Tecla stone slab fragments have been identified in more remote locations, such as *Caesaraugusta* or *Caesar Augusta* (modern Zaragoza),<sup>23</sup> upstream the Ebro (ancient *Hiberus*) river, and the coastal town of *Carthago Nova* (modern Cartagena).<sup>24</sup> The presence of Santa Tecla stone in these relatively distant places is surprising, but the recent petrographic and cathodoluminescence analysis allow to confirm this identification.

Nevertheless, within this area, the distribution of influence is uneven. The main part of the objects made of this material were found in Tarragona (ancient Tarraco) and its hinterland<sup>25</sup> but the presence of Santa Tecla stone objects at Barcelona (ancient *Barcino*)<sup>26</sup> and its surrounding territory is also fairly important: it is found e.g. at Rubí,<sup>27</sup> Castellbisbal,<sup>28</sup> Terrassa (ancient *Egara*), Badalona (ancient *Baetulo*),<sup>29</sup> Mataró (ancient *Iluro*),<sup>30</sup> Cabrera de Mar,<sup>31</sup> and as far as Prats de Rei towards the interior as well as Caldes de Montbui (ancient *Aquae Calidae*) and Granollers towards the north. The number of epigraphic monuments found further inland, namely at Guissona (ancient *Iesso*) and Lleida (ancient *Ilerda*),<sup>32</sup> is much more restricted. However, what really stands out of the general distribution overview is the absence of Santa Tecla stone at Girona (ancient *Gerunda*) and Empúries (ancient *Emporiae*), on the northeast corner of present day Catalonia, and Isona (ancient *Aeso*). Due to the concurrence of other local Cretaceous limestones of similar aspect and quality, the import of Santa Tecla stone objects did not enjoy much success—using nearby material, such objects could be locally produced and consumed. Likewise, the existence of *broccatello*<sup>33</sup> at Tortosa (ancient *Dertosa*) explains the lack of epigraphy and other elements in Santa Tecla stone. Towards the south, however, its influence extends as far as Sagunt (ancient *Saguntum*), where Buixcarro stone, a local bluish-grey limestone, predominates. As we have mentioned, the presence of Santa Tecla stone at Cartagena has been confirmed.



Another factor that helps explain this relatively wide diffusion is the probable export of semi-manufactured or finished monuments. These items, such as the tripartite pedestals, show a strong uniformity not only in the raw material (Santa Tecla stone) but also in their typology.

### Chronological Framework

Because of the lack of clear evidence in the quarries, epigraphy emerges as the crucial and only reliable source of chronological data about the exploitation of Santa Tecla. Thus, the first attested testimony of this stone use is a slab from Tarraco, dedicated to Tiberius before his appointment as emperor (Fig. 11 - Pl. I.7); it dates from 16 BC to 14 AD.<sup>34</sup> However, this material became widely extracted and used under the Flavian dynasty, and, no doubt, also after Vespasian's death. Examining epigraphic monuments, the beginning of the massive extraction can be dated *circa* 70 AD; it increases during the Antonine and Severian periods. Large-scale extraction seems to coincide with an ideological change in the conception of urban architecture: the large supply and ready availability of Santa Tecla stone is reflected on the improvement of the town's layout and its generous ornamentation. Epigraphically, the beginning of the decline is signaled by the reuse of early imperial inscriptions such as C. Clodius Chariton's pedestal, which became the support of a dedication to Ulpia Severina,<sup>35</sup> Emperor Aurelian's wife, or P.Licinus Laevinus' pedestal, which bears three subsequent inscriptions dedicated to emperor Carus, emperor Licinius and emperor Constantinus respectively.<sup>36</sup> Nevertheless, epigraphic monuments begin to be reused not only at Tarraco but in other towns, too; an illustrative case is the pedestal dedicated to N. Aemilianus Dexter, which dates from Theodosian times (c. 387),<sup>37</sup> found at Barcino. The simultaneity of this phenomenon strongly suggests that the supply and transport where in fact interrupted. Even if we cannot extrapolate this interruption to the quarrying activities, it is indeed manifest that Santa Tecla stone extraction slowed down from late 3<sup>rd</sup> century AD and especially during the 4<sup>th</sup> century AD. Most likely, a change took place in the organization of this industry, and in the production of Santa Tecla stone objects. However, the production of sarcophagi in Santa Tecla stone continued to flourish during this period and afterwards.<sup>38</sup>

Consequently, it seems plausible that the quarries were still open, though the extraction activity was less intensive than before. It is difficult to determine a specific date for the end of Santa Tecla stone extraction, since the use of already detached blocks, of previously discarded blocks, or the reuse of earlier elements may diffuse our perception. Besides, one must bear in mind that, as in many other quarries, the extraction activity did not come to an end suddenly, but in a slow process during which the conditions were especially favorable for a major boost of reuse trade.

## Abstract

One of the most characteristic local materials used for decorative purposes by the Romans in the NE part of the Iberian Peninsula is the marmor of Tarraco or Santa Tecla stone. It is a Cretaceous limestone of a yellowish colour, white spots (recrystallized calcite) and small dark red veins (mineralized stylolites). Samples were observed and characterized by optical microscopy and cathodoluminescence technique (CL). The use of Santa Tecla stone is documented since Augustan times, and although it was mainly used on a local basis, it was also object of a relatively wide, regional distribution.

## Résumé

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Le marmor de Tarraco ou la pierre de Santa Teclane est une des matières locales les plus caractéristiques employées dans un but décoratif par les Romains, dans le nord-est de la péninsule Ibérique. La pierre de Santa Tecla est une roche calcaire du Crétacé qui a subi une forte diagenèse. De coloration jaunâtre tachetée de blanc (calcite recristallisée), elle comporte de petites veines rouges (stylolites minéralisés d'oxyde de fer). Ce matériau a été étudié au microscope pétrographique et par cathodoluminescence. L'utilisation de la pierre de Santa Tecla est documentée depuis la période augustéenne et bien que son utilisation fût principalement locale, la pierre faisait également l'objet d'une distribution relativement large et régionale.

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Keywords – Marmor, Tarraco, Roman Spain, archaeology, epigraphy, quarries, cretaceous limestone, petrographic microscope, cathodoluminescence

Mots clefs – Marmor, Tarraco, Hispanie romaine, archéologie, épigraphie, carrières, calcaire crétacique, Microscope pétrographique, cathodoluminescence



notes

1. IRC IV 107 and 108; they are currently deposited at Museu d'Història de la Ciutat de Barcelona (MHCB) and Museu d'Arqueologia de Catalunya – Barcelona (MAC), respectively.
2. RIT 441.
3. R.J. Dunham, 1962, p. 108-121.
4. R.L. Folk, 1962, p. 1-38.
5. V.P. Wright, 1992, p. 117-185.
6. Quarry sites 6, 7 and 9 were lost due to very recent quarrying at La Bulladera.
7. El Llorito 10 seems to be related to a 19<sup>th</sup> century fort remains that stand on top of the hill. As for El Llorito 4, the lack of archaeological excavation prevents us to assign a specific date to this site due to the small changes that extraction methods underwent through the centuries and the well-attested post-Roman use of Santa Tecla stone (in particular during the Baroque period).
8. R.J. Dunham, 1962, p. 108-121.
9. R.L. Folk, 1959, p. 1-38.
10. Santa Tecla stone has been identified at the remains of the Roman circus, Amphitheatre and Provincial Forum at *Tarraco*, see A. Àlvarez et al., 1994, p. 25.
11. IRC I 86 (IRC V ad IRC I 86) from Can Modolell (Cabrera de Mar).
12. IRC I 56 from Rubí and IRC I 144 from Badalona (ancient *Baetulo*).
13. RIT 210, 216, 635, 645 and 909 which have bas-relief or carved decoration and are date around 100 AD.
14. IRC I, 39 and RIT 19 and 41.
15. RIT 23, 66, 435 from Tarragona; IRC I 157 from Badalona; IRC IV 119-120, 184, 203, 281, 288-289, 296 from Barcelona; and IRC II 76 from Guissona (ancient *Iesso*).
16. M. Claveria, 2001, p. 9 num. cat. 12 and p. 22 num. cat. 31.
17. I. Rodà, 2001, p. 70-71.
18. IRC IV 83, 84, 85, 87, 88, 95, 96, 97, 98, 100 and 103.
19. A volumetric study of the lithic material was undertaken at this site which provided very interesting information as Santa Tecla stone is 55,86% of the total amount of *marmora* used at this site; it illustrates the abundance of its use as decorative stone at the *villae* build on the northeast coast of Spain (A. Àlvarez, M. Mayer, 1998).
20. A. Àlvarez, M. Mayer, 1990; A. Àlvarez, M. Mayer, 1998; A. Àlvarez, M. Mayer, J. Pera, 1992; P. Otiña, 2002; P. Otiña, 2003; P. Otiña, 2005. For the use of Santa Tecla stone in *opus sectile*, see E. Pérez Olmedo, 1996, p. 26, 82-83, 88, 95, 180.
21. M. Claveria, 2001a, p. 9 num. cat. 12 and p. 22 num. cat. 31.
22. Santa Tecla stone is a very fine microsparitic limestone with mineralised stilolites and no fossils. On the other hand, 'kadel' stone is an heterogranular biosparitic limestone with plenty of fossils; stone with these last features is not found around Tarragona (I. Rodà, 1990, p. 727-735).



23. Slabs fragments were identified in the orchestra of the Roman Theatre (M.P. Lapuente, 1999; M.P. Lapuente, B. Turi, Ph. Blanc, 2006, p. 83-94).
24. B. Soler, 2003, p. 167, 178, fig. 8; B. Soler, 2005, p. 49, 58. Our warmest thanks go to archaeologist Begoña Soler for kindly providing us with a large collection of samples from *Carthago Nova*.
25. The best examples are the Roman villae of Centcelles (Constantí), Els Munts (Altafulla) and Els Antigons (Reus).
26. See above, the already mentioned parallelepipedical pedestals.
27. Can Fatjó, Can Carabassa, Sant Llorenç, Can Tintorer, Sant Llorenç de Fontcalçada.
28. Can Pedrerols de Baix.
29. IRC I 135, 137-138, 140.
30. Crustae and slabs from Can Xammar and Torre Llauder; epigraphic elements (IRC I 97-100, 103, 105) from Mataró.
31. Can Modolell.
32. Pedestals IRC II 1, 3, 6 from Lleida and four fragments of a same plaque from Guissona (IRC II 76).
33. Locally called Jaspí de la Cinta (G. Borghine, 1989, p. 198; R. Gnoli, 1971, p. 210-211; L. Lazzarini, 2004, p. 100, 118; M. Mayer, I. Rodà, 1999).
34. RIT 66.
35. RIT 457 and RIT 87, respectively.
36. RIT 171, RIT 87, RIT 94 and RIT 95.
37. IRC IV, 36.
38. See M. Claveria, 1998, p. 138-149; 2001b, p. 19-50; I. Rodà, 2002, p. 38.

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