19 THE MIDDLE PLEISTOCENE LARGE MAMMAL FAUNA FROM KYPARISSIA (PELOPONNESE, S. GREECE): NEW COLLECTED MATERIAL

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19.1 INTRODUCTION

Kyparíssia is a fossil vertebrate locality of Middle Pleistocene age, situated at the NW margin of the Megalopolis Basin (central Peloponnese, Greece), within the homonymous lignite mine. The Megalopolis area, an intramontane basin filled mainly with Pleistocene fluvial and lacustrine sediments, is well known since the dawn of the 20th century for its palaeontological wealth, particularly regarding fossils of mammalian megaherbivores (see Athanassiou, 2018; Athanassiou et al., 2018; Konidaris et al., 2018; and references therein). The development of extensive open-cast mines since 1970 provided access to long and deep stratigraphic sections, facilitating the discovery of new sites. The Kyparíssia mine is the northernmost in the basin and was in full operation until 2006. The mine area is filled with lacustrine deposits, dominated by thick lignite layers, which are covered unconformably by fluvial and alluvial fan sediments.

The first fossils in the area of the mine came to light in October 2004, when a large part of a section collapsed, exposing elements of an elephant skeleton among the rubble. Subsequent fieldwork during the following years resulted in the discovery of five sites (KYP1–KYP4, KYPT), mainly along the western margin of the mine (Athanassiou, 2018: Fig. 1). According to our current understanding of the locality's stratigraphy, the finds come from two main fossiliferous levels with an altitude difference of about 15 m, which are not expected to differ significantly, at least concerning the large mammal association. The fauna was pub-

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lished by Athanassiou (2018) and Athanassiou et al. (2018), who described the following taxa (collectively from all KYP sites): turtles (*Emys orbicularis, Testudo marginata*), birds (*Anas crecca*, *Anas platyrhynchos*, *Cygnus olor*, *Mareca strepera*, *Spatula clypeata*, *Spatula querquedula*, *Fulica atra*, *Anhinga* sp.), a rodent (*Castor fiber*), carnivorans (*Canis* sp., Hyaenidae indet., *Felis* sp., *Panthera* sp.), a proboscidean (*Palaeoloxodon antiquus*), perissodactyles (*Stephanorhinus* sp., *Equus* sp.) and artiodactyles (*Sus scrofa, Hippopotamus antiquus*, *Praemegaceros verticornis*, *Cervus elaphus*, *Dama* sp., *'Cervus' peloponnesiacus*, Cervidae indet., and *Bison* sp.).

This diverse fauna indicated the great potential of the locality. Thus, a new 3-year field research program was initiated at Kyparíssia in 2019, as part of the Megalopolis Palaeoenvironmental Project (MegaPal), in order to further investigate its palaeontological content, stratigraphy, and possible human presence (Karkanas et al., this volume). The new research focused mainly on the KYP4 site, an area with dense fossil content, discovered in 2007. A significant new discovery is the recovery of several lithic artifacts at KYP4 in direct stratigraphic and spatial association with fossils. Moreover, a new site, named Kyparíssia-5 (KYP5), was discovered in 2021, ~200 m NNE of KYP4. In general, finds from other locations within the mine are scarce. Both sites, KYP4 and KYP5, are situated very close to a basement outcrop (limestones of the Pindos geotectonic zone) and correspond to a depositional environment very close to the lake shore. They both belong to the lower fossiliferous level of the locality. At KYP4 two main areas of interest were designated, Area A (corresponding to the fossiliferous findspot in Athanassiou, 2018) and Area B, to the east of Area A, which represents one exposed section profile along the current lake shore; in addition, a third findspot in between these areas yielded few fossils and was designated as Area C. The main vertebrate-bearing layers generally consist of dark grey sandy muds, rich in organic remains, mud clasts and mollusc shells.

Below, we present a brief preliminary description of the most important new large mammal finds and an update on the locality's faunal content. The studied specimens were numbered sequentially for the entire locality, but each number is preceded by the abbreviation of the corresponding site. The specimen numbers of unstratified finds are preceded by the locality abbreviation (KYP). The tooth positions are indicated as: P/p, upper/lower premolar; M/m, upper/lower molar. All measurements are in mm. The use of parentheses denotes an inaccurate or estimated measurement. Measurement abbreviations: L, length; W, width (p, proximal; d, distal; a, articular); H, height. All fossils presented herein are stored in the collections of the Ephorate of Palaeoanthropology–Speleology (Hellenic Ministry of Culture, Athens, Greece).

19.2 SYSTEMATICS

19.2.1. RODENTIA

A large-sized rodent of castorid morphology is present in KYP4, represented in the recently collected material by a left hemimandible (Fig. 1a). The specimen preserves the complete cheek tooth row (p4–m3), as well as the incisor, which extends through the entire ventral part of the mandible (> 90 mm, along its labial side), but is broken supralveolarly. The incisor is triangular in cross section and has a smooth and flat enamel band on its labial side, excluding an attribution to *Trogontherium cuvieri* and pointing to the extant Eurasian species *Castor fiber* (Fostowicz-Frelik, 2008). The cheek teeth are very hypsodont with very deep striids, in accordance with the morphology of *Castor fiber*. This is the first occurrence of this species in KYP4.

19.2.2. CARNIVORA

This order is represented in the new KYP collection by a partial skull of a fox (*Vulpes* sp.) from KYP4, and a partial ursid mandible (*Ursus* sp.; surface find). The former preserves the left rostral part of the skull with P4–M2 (KYP4-1160; Fig. 1b). Dimensionally, the teeth are small (P4: 12.2×5.7, M1: 9.0×10.3, M2: 5.7×7.3 mm), being comparable to those of *Vulpes alopecoides* and the small-

Figure 1: Rodentia, Carnivora, Perissodactyla and Artiodactyla from Kyparíssia: a, *Castor fiber*, left mandible (KYP4-1163) in dorsal (a1) and lingual (a2) view; b, *Vulpes* sp. (KYP4-1160), partial skull in left lateral (b1) and ventral (b2) view; c, *Ursus* sp. (KYP-1161), partial mandible in dorsal (c1) and lingual (c2) view; d, *Hippopotamus antiquus* (KYP4-1004), left maxilla in ventral (occlusal) view; e, *Hippopotamus antiquus* (KYP4-1006), partial right mandible in occlusal (e1) and right lateral (e2) view; f, *Equus* sp. (KYP4-1151), m1/2 in occlusal view; g, *Stephanorhinus* sp. (KYP4-1197), left P3/4 in occlusal view; h, *Stephanorhinus* sp. (KYP4-1195), left astragalus in dorsal view. Graphical scale equals 5 cm (a–c, f–h) and 10 cm (d, e).

est individuals of *Vulpes vulpes* (Bartolini Lucenti and Madurell-Malapeira, 2020: Fig. 9). The ursid mandible (KYP-1161; Fig. 1c) preserves only the first molar, whose dimensions (L = 26.7 mm, W = 11.9 mm) indicate a large individual, comparable to *Ursus deningeri* or a very large *Ursus arctos* (Rossi and Santi, 2011: Fig. 12). Both *Vulpes* and *Ursus* are new to Kyparíssia, while *Ursus* is a new element for the entire Megalopolis Basin.

19.2.3. PERISSODACTYLA

Rhinoceroses and horses are rare faunal elements in the Megalopolis Basin. Rhinoceros finds from this region have been historically referred to multiple species, but they are currently considered as *Stephanorhinus* sp. (Giaourtsakis, 2022 and references therein). New finds from Kyparíssia include two cheek teeth, cervical vertebrae, and some other postcranial bones. The teeth (KYP4-1196, KYP4-1197; Fig. 1g) are almost totally worn and may belong to the same individual, as they were also found in spatial proximity. Their proportions indicate that they are probably premolars (P3/4). The postcranial elements (carpals, tarsals, metapodials) indicate a rather small-sized species, such as *Stephanorhinus hemitoechus* (see Guérin, 1980), but they do not provide any diagnostic character for a species-level determination. The horses (*Equus* sp.) are represented by just one isolated lower tooth (KYP4-1151), a little-worn right molar (m1 or m2; Fig. 1f) (L=28.0, W=(14), H=66 mm). Both perissodactyl taxa are new for KYP4.

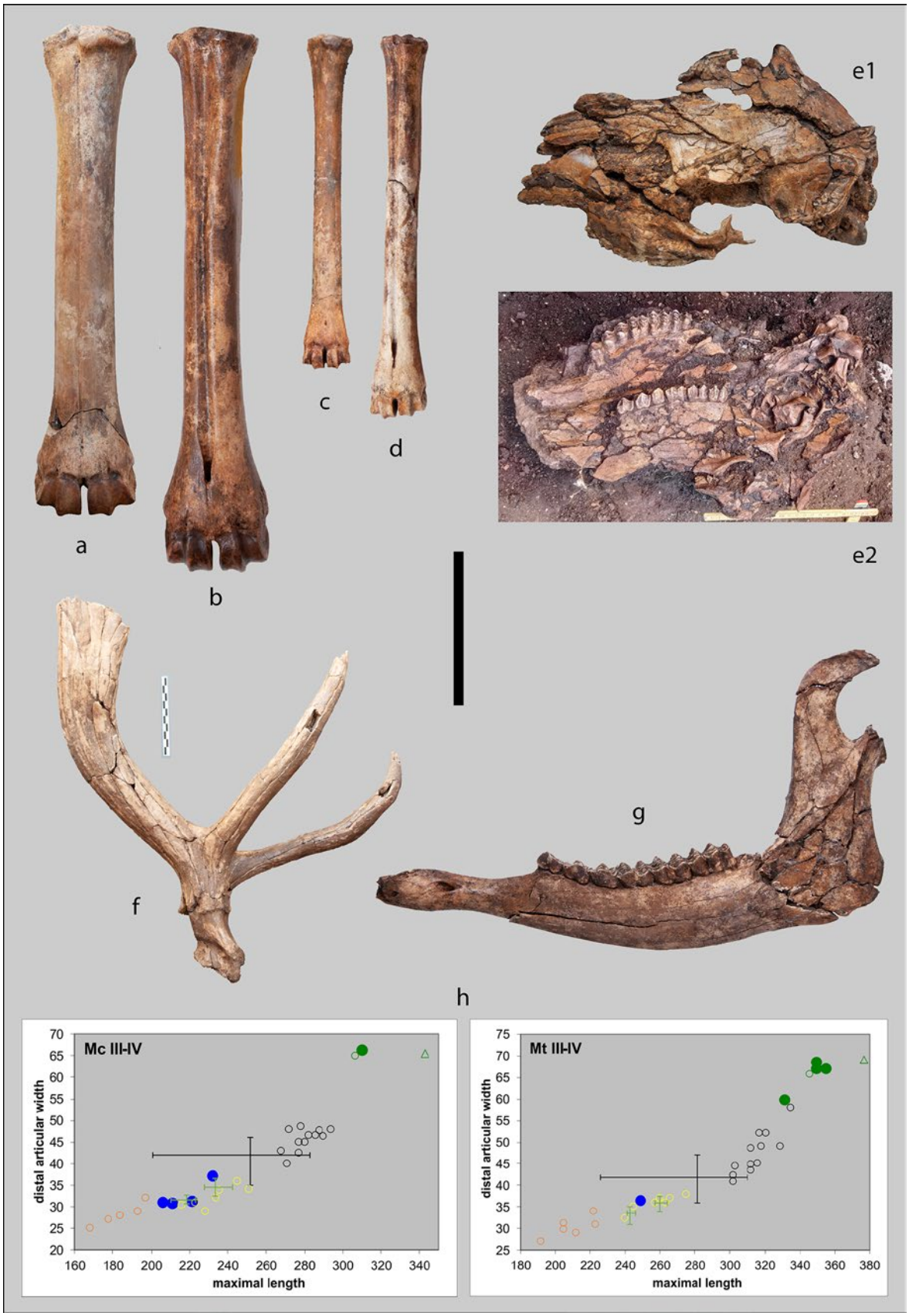
19.2.4. HIPPOPOTAMIDAE

Hippopotamus antiquus is a frequent taxon in Kyparíssia (Athanassiou et al., 2018). The recently collected material includes a fragmentary skull preserving parts of the maxillae and the occipital region, as well as the left P4–M3 row (KYP4-1004; Fig. 1d), a right partial mandible with the complete molar row (surface find, KYP4-1006; Fig. 1e), isolated teeth, and several postcranial elements of the axial and appendicular skeleton. All three areas of KYP4 have yielded hippopotamus finds. Those from Area B (nine vertebrae, more than eleven ribs, scapular fragments, a partial humerus, a cuneiform) probably belong to a single individual.

The preserved dental row of the skull KYP4-1004 has a molar-series length of 168 mm. The M1 is almost worn out, the P4 and M2 exhibit medium wear, while the M3 is almost unworn and not fully erupted. A separately found, large-sized upper canine (surface find at KYP4B; maximal diameter: 59.5 mm) has the characteristic pisiform cross section. A fragmentary lower canine is similarly robust (maximal diameter: 68.0 mm). The mandible KYP4-1006 belongs to a young adult individual with a moderately worn m1, a slightly worn m2, and an unworn and still-erupting m3.

A right third metacarpal (KYP4-1007) (L=168.7 mm, Wpa=67.0 mm, Wda=60.6 mm) compares with the largest specimens of *Hippopotamus antiquus* given by Kahlke (1997) and Mazza (1995). On the contrary, a right second metatarsal (KYP4-1008) is small, similar to the smallest specimens of the same species.

Figure 2: Cervidae from Kyparíssia: a, *Praemegaceros verticornis* (KYP4-1050), right metacarpal III-IV in dorsal view; b, *Praemegaceros verticornis* (KYP4-1048), right metatarsal III-IV in dorsal view; c, *Dama* sp. (KYP-1090), right metacarpal III-IV in dorsal view; d, *Dama* sp. (KYP4-1093), right metatarsal III-IV in dorsal view; e, *Praemegaceros verticornis* (KYP4-1067), skull in dorsal (e1) and ventral (e2) view; f, *Cervus elaphus* (KYP5-1194), right antler in lateral view; g, *Praemegaceros verticornis* (KYP4-1069), left mandible with p2–m3 in lateral view; h, cervid metapodial scatter diagrams comparing *Dama* sp. (blue dots) and *Praemegaceros verticornis* (green dots) from KYP4 to recent *Dama dama* (orange open dots), *Dama clactoniana* (yellow open dots), *Cervus elaphus* from Mosbach (black open dots), *Praemegaceros verticornis* from Voigtstedt (green open dot) and Bilshausen (green open triangle). Green lines represent the ranges of female and male *Dama dama geiselana*, respectively; black lines the range of recent *Cervus elaphus* from Italy. The Mt III-IV plot includes two *Praemegaceros* specimens (KYP4-301 and KYP4-302) published by Athanassiou (2018). Comparative data from Kahlke (1965), Leonardi and Petronio (1976), Pfeiffer (1998, 2002), Di Stefano et al. (2015) and Stefaniak (2015). Graphical scale equals 10 cm (a–d) and 20 cm (e–g).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Mt III-IV
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19.2.5. CERVIDAE

Three size-groups of Cervidae have been identified in the new material, dimensionally corresponding to fallow deer, red deer, and giant deer. Both cranial and postcranial specimens are available. Fallow deer-sized material (*Dama* sp.) comprises isolated teeth and postcranial elements, most notably six complete metapodials (Fig. 2c, d). These belong to a fairly large fallow deer, similar in size to the Middle Pleistocene *Dama clactoniana* and the Eemian *D. dama geiselana* (Fig. 2h), but smaller than *Dama roberti* (see Breda, 2015).

The red deer, *Cervus elaphus*, is best represented in KYP5, where a partially preserved, unshed right antler has been collected. This specimen (KYP5-1194; Fig. 2f) is large-sized, and preserves part of the pedicel, the burr, the proximal part of the beam (up to a height of 45 cm, following its caudal face), as well as the two first tines. No new dental or postcranial specimens from KYP4 can be securely referred to this species.

On the contrary, the giant deer *Praemegaceros verticornis* is well represented at KYP4 by a skull (KYP4-1067; Fig. 2e), two left hemimandibles (KYP4-1068 and KYP4-1069; Fig. 2g) and several postcranial bones (Fig. 2a, b). The skull is very fragmentary because it has suffered a severe, probably syndepositional, dorsoventral compression. It lacks antlers, so it belongs to a female individual. Both dental rows are preserved. Their size (LPM=134 mm, LP=57–61 mm, LM=81 mm) is very similar to KYP4-633 (Athanassiou, 2018: Table 5) and the sample from Voigtstedt, Germany (Kahlke, 1965), but smaller than KYP2-345 (Athanassiou, 2018: Table 5), West Runton, Great Britain (Azzaroli, 1953: p. 61) and Süßenborn, Germany (Kahlke, 1969: p. 573).

The mandibles are not particularly pachygnathic. The lower dentition features a semimolarized p4 and a non-molarized p3. Dimensionally, the lower dentitions are slightly (~5%) larger than their conspecifics from Mosbach and Süßenborn, Germany (Kahlke, 1960, 1969) and very similar to those from Voigtstedt (Kahlke, 1965). The postcranial elements are robust and very similar dimensionally to those from Voigtstedt, as well. A metrical comparison of the metapodials is given in Fig. 2h.

19.2.6. SCARCELY REPRESENTED TAXA

A distal part of a left femur collected at KYP3, as well as a left metatarsal IV (surface find south of KYP1) belong to an elephantid, and are consistent with an attribution to *Palaeoloxodon antiquus*, a species previously documented in the locality (Athanassiou, 2018). A suid upper canine (surface find at KYP4A) is referred to a male *Sus scrofa*. In addition, a primate upper molar, collected at KYP4 (KYP4-1075) and referred to *Macaca sylvanus*, is described in a separate report (Konidaris et al., this volume) and is a new faunal element for Kyparíssia.

19.3 BIOCHRONOLOGY–PALAEOECOLOGY

Most of the taxa represented in the Kyparíssia fauna have rather wide biostratigraphic ranges. Most characteristic is the cervid *Praemegaceros verticornis*, which appeared at about 0.8 Ma and became extinct at 0.4 Ma (Croitor, 2006). The absence of this taxon from Marathousa 1, dated to 0.42–0.48 Ma (Konidaris et al., 2018; Tourloukis et al., 2018), if not accidental, may indicate an earlier local extinction and an earlier date for Kyparíssia. The study of micromammals is more informative in terms of biochronology, since van Kolfschoten et al. (this volume) document the presence of *Mimomys* spp. and *Microtus (Microtus)* in KYP4, thus constraining its age to 0.6–0.8 Ma.

Palaeoecologically, the recently collected material corroborates our understanding of the Middle Pleistocene environment of Kyparíssia as a vegetation-rich lacustrine habitat, surrounded by mixed deciduous forests and woodlands, which, as a permanent body of water, attracted animals from the wider area (Athanassiou, 2018; Athanassiou et al., 2018). Concerning the new reported faunal elements from Kyparíssia, the presence of the beaver, which uses trunks and branches to build dams, further supports the existence of extended forested lake shores, while *Macaca* (see Konidaris et al., this volume), *Vulpes* and *Ursus* are also taxa that thrive in forested environments. The scarce presence of the horse, and to a lesser degree of the rhinoceros, is the only indication of more open stretches of land, though possibly at a certain distance from the lake area. Further palaeoenvironmental indications for KYP4 are provided in Boni et al. (this volume) and Papadopoulou et al. (this volume).

19.4 CONCLUSIONS

Renewed research at Kyparíssia, carried out during the years 2019–2021 has added new material, new taxa and an additional site to the already published ones. The fossils collected from KYP4 corroborate the abundance of *Hippopotamus* (including a partial skeleton) and cervids in the fauna, particularly those of the genus *Praemegaceros*. A close stratigraphic association of the fossils with lithic

Order	Family	Taxon	KYP	KYP1	KYP2	KYP3	KYP4	KYP5	KYPT
Rodentia	Castoridae	*Castor fiber*	●				●		
Primates	Cercopithecidae	*Macaca sylvanus*					●		
Carnivora	Ursidae	*Ursus* sp.	●						
	Canidae	*Canis* sp.	●						
		Vulpes sp.					●		
	Hyaenidae	Hyaenidae indet.	●			●			
	Felidae	*Panthera* sp.				●			
		Felis sp.				●			
Proboscidea	Elephantidae	*Palaeoloxodon antiquus*	●	●		●	●		
Perissodactyla	Rhinocerotidae	*Stephanorhinus* sp.	●				●		
	Equidae	*Equus* sp.	●	●			●		
Artiodactyla	Suidae	*Sus scrofa*	●			●	●		
	Hippopotamidae	*Hippopotamus antiquus*	●	●		●	●		●
	Cervidae	*Praemegaceros verticornis*	●	●	●	●	●		
		Cervus elaphus	●	●		●	●	●	
		Dama sp.	●	●		●	●		
		´Cervus´ peloponnesiacus	●	?		?	?		
		Cervidae indet.	●	?		?	?		●
	Bovidae	*Bison* sp.	●	●			●		

Table 1: Comprehensive list of large fossil mammals from Kyparíssia, indicating the faunal content of each site (KYP1–KYP5, KYPT), as well as unstratified material (KYP). Combined data from Athanassiou (2018), Athanassiou et al. (2018) and the present study. Documented presence is indicated by '●', possible presence by '?'.

artefacts was also documented for the first time, underlining the archaeological significance of the site (Karkanas et al., this volume). Several taxa are recorded for the first time at KYP4: *Castor fiber*, *Stephanorhinus* sp., *Equus* sp., *Sus scrofa*, *Vulpes* sp. and *Macaca sylvanus*. *Ursus* sp., found south of KYP4, was so far unknown from any locality within the Megalopolis Basin. Finally, a new site, KYP5, was discovered. The new faunal list of Kyparíssia (Table 1) is compatible with the previously proposed early Middle Pleistocene age of the locality (Athanassiou, 2018).

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