New data on the Middle Pleistocene endemic Sicilian hippo (*Hippopotamus pentlandi*)

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Abstract. The skeletal and dental remains of a Late Middle Pleistocene-Late Pleistocene hippo coming from site K22 (Capo San Vito Peninsula - Trapani) in Western Sicily have been studied and the biometric data have been compared with other fossil Sicilian taxa with the aim of detecting possible morphological differences.

Keywords: *Hippopotamus pentlandi*, Westernmost Sicily, late Middle Pleistocene-Late Pleistocene, Mammalia.

INTRODUCTION

The taxonomic relationship of fossil endemic mammals on Mediterranean islands with their continental counterparts is a question debated by paleontologists since the last two centuries. Among large mammals, hippos inhabited western and eastern Mediterranean islands during Pleistocene times. Apart the size - being the endemites smaller - numerous morphological characters distinguish the island inhabitants from their continental forerunners.

The Sicilian hippo has been firstly informally described by Pentland (1832) who considered the taxon peculiar for Sicily similar to the living hippo (*Hippopotamus amphibius*) but of reduced size and demanded a formal attribution. In the same year the Sicilian hippo received its formal name *Hippopotamus pentlandi* von Meyer 1832. Moreover in Malta was found a smaller taxon named *Hippopotamus minutus* Blainville 1847 nowadays considered synonymous pro parte of *Hippopotamus melitensis* Major 1902. Falconer (1868) and Woodward (1886) considered the smaller Maltese form different from the Sicilian one and attributed all the Maltese taxa to *H. minutus* and the Sicilian ones to *H. pentlandi*.

During the nineteenth century all the hippo fossil remains discovered in Malta have been identified alternatively as *H. pentlandi* or *H. minutus* only on the base of their size. Moreover, in 1902 Major recognized in Malta the new species *Hippopotamus melitensis* of intermediate size between *H. pentlandi* and *H. minutus*. The taxonomic position of Sicilian hippo has been matter of discussion even for the whole twentieth century especially on regard of his relation with the continental extant or fossil forms. Following Accordi (1955) the morphological differences between the fossil Sicilian *H. pentlandi* and the extant African *Hippopotamus amphibius* are sufficient to justify the different specific status. However, Capasso Barbato & Petronio (1983) consider the Sicilian taxon as a subspecies of *Hippopotamus amphibius* (*H. a. pentlandi*). Caloi et al. (1980) and Caloi & Palombo (1986) unearth the old name "*Hippo-*

potamus antiquus" to indicate the large sized European taxon *Hippopotamus major* of the Early Pleistocene and identify the younger continental species (late Middle Pleistocene in age) as the extant *H. amphibius*. Faure (1984, 1985) and Faure & Guerin (1989) do not accept the phylogenetic link of the Sicilian fossil taxon with the African extant hippo, and do not even recognize the existence of *H. amphibius* in Europe. They consider the existence of two fossil forms in Europe: the elder *H. major* and the younger *H. incognitus*, the latter misidentified as *H. amphibius*. Faure (1983) in particular, believes that the endemic Sicilian taxon *H. pentlandi* derived from *H. major*, and in turn, that the Maltese *H. melitensis* derived from *H. pentlandi*. Bonfiglio (1992) studied the biometry of a rich sample of fossil hippo coming from the talus of Acquedolci in front of Grotta of San Teodoro (Messina) and concluded that the size values of the bones fall within the lower value range of the extant *H. amphibius*. Consequently Bonfiglio (1992) considers that the modest size reduction can not justify the new specific or sub-specific status claimed for the Sicilian form and considered it as *Hippopotamus amphibius.* The chronology of the fossil Sicilian hippo has been fixed in the few last years with the update of the Sicilian Biochronological scheme to the interval late Middle Pleistocene - Late Pleistocene. In Tab. 1 is resumed such scheme that shows the succession of mammal assemblages (the so called "Faunal Complexes") during Pleistocene (Bonfiglio et al., 2001, 2002). The hippo occurs in the *Elephas mnaidriensis* Faunal Complex (FC), late Middle Pleistocene-early Late Pleistocene in age, together with the modestly reduced in size elephant *Elephas mnaidriensis* (synonym of *Paleoloxodon mnaidriensis* according to Ferretti, 2008), some other large herbivores (slightly smaller than Italian counterparts at the extent to be geographic subspecies) and an adequate number of carnivore species that makes the assemblage well balanced and diversified while the cohort of small mammals derive from the previous FC as they are strongly endemized (a shrew and two giant dormice).

MATERIALS AND METHODS

The hippo remains studied in the present paper come from a fossiliferous site located in the San Vito lo Capo Peninsula (Trapani) in the North-Westernmost Sicily. The area is well known from paleontologists as well as geomorphologists for the several continental fossiliferous deposits, often associated with marine abrasion surfaces, marine deposits or contained within marine caves, testifying marine high stand phases during Pleistocene times (Di Maggio et al., 1999). The fossil hippo material comes from the site known as "K22" close to the town of San Vito lo Capo whose photo is shown in Fig. 1 and was recovered, together with other taxa, during an excavation carried on in 1994 by the Geology and Geodesy Department and the G. G. Gemmellaro Museum of the Palermo University under the supervision of Prof. Federico Masini. The outcrop, consists in a karst cavity filled by 9 m thick sedimentary succession, exposed in an abandoned quarry. The cavity, located at a height of 55 m a.s.l., is close to the eastern edge of the ancient wave - cut cliff, which contours Piana di Sopra and presently opens on the top abrasion surface, the highest and oldest recognized in the area (Di Maggio et al., 1999).

The deposit from the bottom to the top is made up of marine (Fig. 2 levels A and B), transitional (Fig. 2 level C) and continental sediments (Fig. 2 levels D-H) (Petruso unpublished, 1996; Di Maggio et al., 1999; Masini et al., 2004). The continental series begins with a conglomerate (Fig. 2 level D) 2 meter thick made up of limestone pebbles surrounded by a

Tab. 1 – Sicilian Biochronological Scheme (Modified from Bonfiglio et al. 2001).

Faunal Complexes	**Taxa**	**Assemblage characteristics**
Castello FC	*Canis lupus* *Vulpes vulpes* *Equus hydruntinus* *Cervus elaphus* *Bos primigenius* *Sus scrofa* *Erinaceus europaeus* *Crocidura* cf. *sicula* *Microtus (Terricola)* cf. *savii* *Apodemus* cf. *sylvaticus* *Lepus europaeus* vel *corsicanus*	No endemic assemblage. Diffusion of humans. Relative Age: top Late Pleistocene (late Pleniglacial - Late glacial). Absolute Age: from 13.760 ± 330 B.P. to 10.370 ± 100 (Bonfiglio e Piperno 1996)
Grotta di San Teodoro-Contrada Pianetti FC	*Crocuta crocuta spelaea* *Canis* cf. *lupus* *Vulpes vulpes* *Ursus* cf. *arctos* *Equus hydruntinus* *Paleoloxodon mnaidriensis* *Cervus elaphus siciliae* *Bison priscus siciliae* *Bos primigenius siciliae* *Sus scrofa* *Erinaceus europaeus* *Crocidura* cf. *sicula* *Microtus (Terricola)* ex gr. *savii* *Apodemus* cf. *sylvaticus*	Reduced or no endemic assemblage. Extinction of small endemic mammals and of some large mammals of previous FC. Relative Age: top Late Pleistocene (Interpleniglacial).
Paleoloxodon mnaidriensis FC	*Panthera leo spelaea* *Crocuta crocuta* cf. *spelaea* *Canis lupus* *Ursus* cf. *arctos* *Lutra trinacriae* *Paleoloxodon mnaidriensis* *Hippopotamus pentlandi* *Dama carburangelensis* *Cervus elaphus siciliae* *Bos primigenius siciliae* *Sus scrofa* *Crocidura* aff. *esuae* *Leithia* cf. *melitensis* *Maltamys* cf. *wiedincitensis*	Moderate endemic characteristics of large mammals derived from dispersal events from the Southern Italian Peninsula while small mammals endemites survived from the previous FC. Relative Age: late Middle Pleistocene - base Late Pleistocene Absolute Age: 200.000 ± 40.000 anni B.P. (Bada et al. 1991); 146.000 ± 28.000 e 170.000 anni B.P. (Rhodes 1996)
Paleoloxodon falconeri FC	*Vulpes* sp. ? *Lutra trinacriae*	Strongly endemic assemblage with dwarf elephant and giant dormice.

continued

Faunal Complexes	Taxa	Assemblage characteristics
	Paleoloxodon falconeri *Crocidura esuae* *Leithia melitensis* *Leithia cartei* *Maltamys gollcheri*	Relative Age: base Middle Pleistocene Absolute Age: 455.000 ± 90.000 anni B.P. (Bada et al. 1991)
Monte Pellegrino FC	*Pannonictis arzilla* *Asoriculus burgioi* *Apodemus maximus* *Maltamys n. sp.* *Pellegrinia panormensis* *Hypolagus peregrinus*	Strongly endemic taxa together with slightly reduced endemic ones. Poliphasic dispersals from Africa and Europe. Relative Age: Early Pleistocene

Fig. 1 – Photo of K22 outcrop during the excavation of 1994.

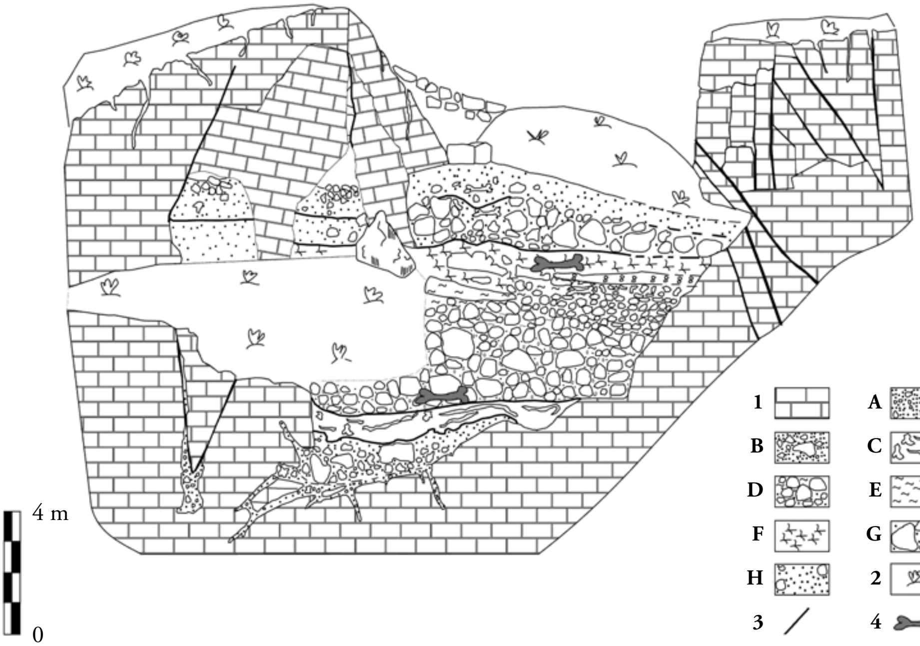

Fig. 2 – Schematic section of the outcrop of "K22". Legend: 1. Coralgal limestone (middle- late Cretaceous); A. marine sandstone; B. lower conglomerate; C. pinkish transitional sandstone; D. upper continental conglomerate (late Middle Pleistocene–early Late Pleistocene); E. orange lens (late Middle Pleistocene–early Late Pleistocene); F. red horizon and petrocalcic level (late Middle Pleistocene–early Late Pleistocene); G. pebble level (Interpleniglacial); H. brown anthropic level (Late glacial - Holocene); 2. reworked sediments; 3. Faults; 4. Hippo bones recovery. (Modified from Di Maggio et al., 1999).

sandy matrix strongly cemented. The conglomerate matrix at the top becomes reddish, thinner and with smaller, angular and encrusted pebbles particularly at the contact with the following red horizon, characterized by polyhedric soil aggregation, abundant coatings, nodules of iron and manganese oxides and carbonate nodular concretions (Fig. 2 level F). The hippo fossil material comes from the base of the conglomerate and from the red horizon where it is associated to other taxa (the boar *Sus scrofa*, the dormice *Leithia melitensis* and *Maltamys wiedincitensis* and the shrew *Crocidura esuae*).

The examined fossil material is represented by 324 skeletal and dental fragments (Tab. 2) stored in the Department of Earth and Sea Science of the Palermo University and has been excavated from the two aforementioned strata (Fig. 2 levels D and F) and collected from the material derived from the erosion of the deposit, or left on floor of the quarry by some amateur collectors. The taphonomic characteristics of the material not in strata such as the crusts of calcium carbonates, the strong impregnation of iron and manganese oxides and the signs of transport flotation, particularly visible on the bones, permitted to recognize their origin from the conglomerate level.

The taxonomic determination was possible only for the 33 % of the bone material since the rest was badly damaged; particularly the remains coming from the conglomerate which

Tab. 2 – Table that resumes the amount of hippo bones coming from K22.

Part of skeleton	**Kind of bone/Teeth**	**Number of remains**
Teeth and gnawing apparatus	2 fragments maxilla, fragment cranial or mandibular element?, 2 lower right M1, 3 fragments lower incisor, 5 fragments canine, 3 fragments incisor, 3 fragments upper juvenile canines, upper left P2 very worn, 3 fragments molar indet. very worn, fragment radix premolar, fragment lower P2 or P3, 9 fragments teeth indet., 2 fragments premolar indet., fragment lower left I3, 2 lower M2, fragment of DP4, fragment upper left I2 very worn	41
Post-cranial bones flat bones and vertebrae	5 fragments of rib, 2 fragments neural arch vertebra, articular facet rib, 4 fragments scapula, caudal vertebra, fragment thorax vertebra, fragment lumbar vertebra	15
Post-cranial long bones	fragment distal epiphysis fibula, fragment proximal epiphysis radius, fragment juvenile II metacarpus, fragment proximal epiphysis humerus, fragment right radius, fragment proximal epiphysis right tibia, complete right tibia, fragment distal epiphysis left tibia, fragment distal epiphysis II-IV metapode, fragment proximal epiphysis metapode	10
Post-cranial short bones and phalanges	2 second phalanges third digit manus, II phalanx fourth digit pes, fragment proximal epiphysis II phalanx, right scaphoid, fragment right navicular, sesamoid third metacarpal?, fragment II phalanx, 2 fragments carpus/tarsus bones, 2 right and left cuboid, fragment sesamoid, right calcaneus, first phalanx III digit manus	15
Hippo bone indet.	fragments bone indet.	about 243

are deformed by crushing due to lithostatic load, broken and with epiphysis smoothed for the rafting transport through pebbles, but more so by the corrosive action of pedogenesis. The thicker and massive limb bones such as calcaneus, tibia etc and dental remains, which are more resistant to the destructive taphonomic processes are the better preserved elements. The bones and teeth have been qualitatively compared with the collection of Acquedolci (Messina) fossil site that Prof. Bonfiglio from the Earth Science Department of Messina University gave at disposal; helping much in the determination of carpus and tarsus bones.

The bones have been measured according to different measurement plans such as that of Khalke (1982), Faure (1983) integrated with some measures by Mazza (1995) while the teeth using only Mazza (1995). Only the 4% of the fossil material have been measured due to its bad conservation status.

It was not possible to test the sample variability because of the paucity of each type of bone or tooth. The quantitative data derived from the measurements have been compared with those coming from the literature or unpublished thesis on other Sicilian hippos (appendix); in particular, the comparison was carried on with two samples of Eastern Sicily from the sites of Acquedolci (Capilli, 1989-90; Brigandi, 1996-97; Garreffa, 1987-88) and Capo Tindari (Caloi & Palombo, 1982) and two samples of Northern Sicily from the sites of La Cannita (Accordi, 1955; Capasso-Barbato & Petronio, 1983) named in the graphs “La Cannita 1” and “La Cannita 2” and from San Ciro (unpublished Capilli, 1989-90). To analyze the size differences of K22 hippo respect to the other samples, two-dimensional scatter diagrams have been used.

RESULTS

The comparison material at disposal do not comprehend all the elements of the skeleton and therefore permitted to compare only some of the bones and teeth of K22 collection. The scatter diagram for the tibia (Fig. 3) in which total length and width of the proximal end are compared, shows that the variables are well correlated; the Acquedolci sample include the longest specimens, La Cannita 1 and La Cannita 2 are somewhat smaller than Acquedolci, while San Ciro and especially K22 samples are the smallest, falling close to the minimum values of the range of La Cannita 1 and 2. Unfortunately the maximal length was measured on only one of the two tibia at our disposal since the other was to smoothed and corroded. Furthermore the measure has been inferred, as the epiphysis are somewhat smoothed by the transport and the pedogenesis (Fig. 4). The calcaneus from K22 instead was complete and better preserved (Fig. 5) and has been compared with those from Capo Tindari, Acquedolci and La Cannita 1. The diagram of Fig. 6 shows again the studied sample as the less elongated, while some of the Acquedolci specimens and the one from Capo Tindari reach the highest length and breadth. La Cannita 1 is on the average shorter than Acquedolci; the diameter of the distal tuberosity of the K22 specimen is not very small as it falls between the lowest (Acquedolci) and the highest values (La Cannita 1).

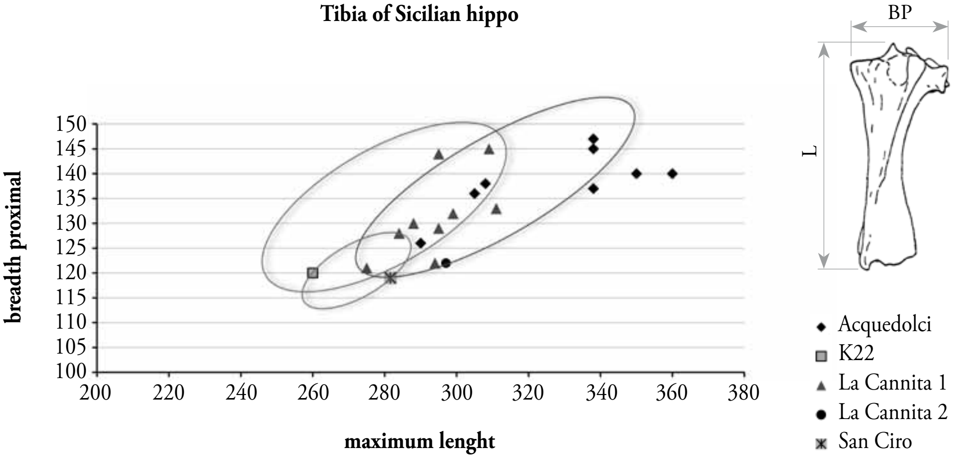

Fig. 3 – Scatter diagram that plots the maximal length and breadth of proximal epiphysis of hippos’ tibia from different Sicilian fossil sites.

Fig. 4 – Photo of the comparison between the tibia coming from Acquedolci (on the right) and that of K22 (on the left) in anterior view. Bar of 8 cm.

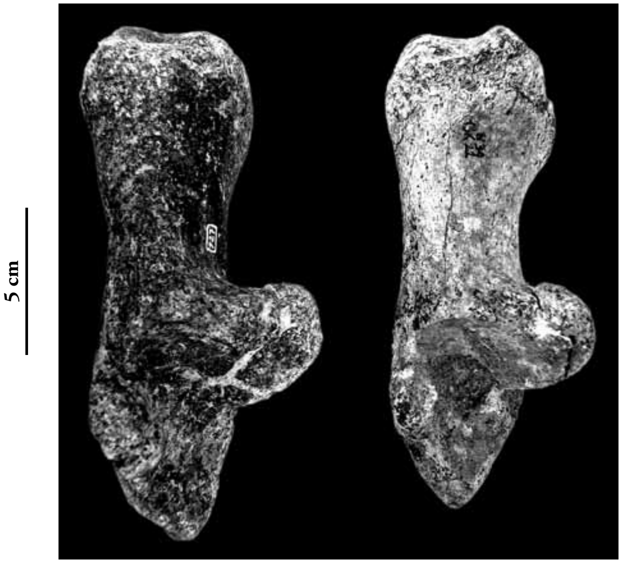

Fig. 5 – Photo of the comparison between the calcaneus coming from Acquedolci (on the left) and that of K22 (on the right) in anterior view. Bar of 5 cm.

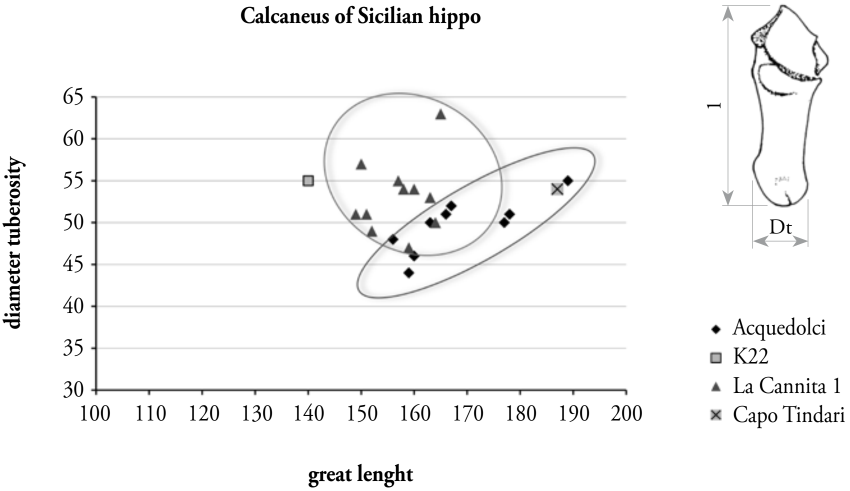

Fig. 6 – Scatter diagram that plots the maximal length and the diameter of tuberosity of hippos' calcaneus from different Sicilian fossil sites.

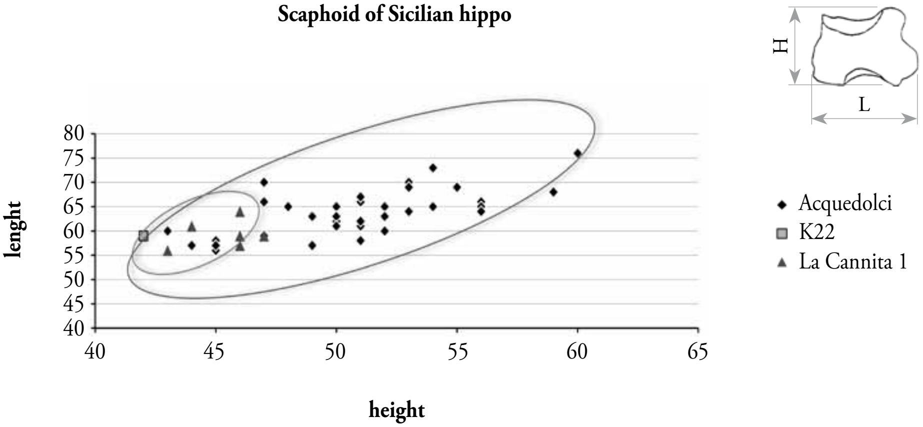

Fig. 7 – Scatter diagram that plots the length and the height of hippos' scaphoid from different Sicilian fossil sites.

The biometric comparisons included also the scaphoid, a short bone of the carpus. The K22 sample has been compared with Acquedolci and La Cannita 1 specimens (Fig. 7). The dimension of the rich Acquedolci sample are correlated and form a very elongated cloud. La Cannita 1 population falls close to the lower values of Acquedolci, confirming its smaller size. The height of K22 scaphoid is even a little smaller than La Cannita 1 demonstrating again that this hippo was one of the smallest. However, the length of K22 specimen is within the range of the shortest Acquedolci and La Cannita 1 bones.

The next short bone considered in the analysis is the cuboid, another tarsal bone. As can be seen in the scatter diagram of Fig. 8, K22 sample has been compared only with the Acquedolci population (Fig. 9); the K22 specimen confirms its small size especially for what concern the length of the bone while the posterior height falls in the variability range of Acquedolci population. The last scatter diagram for post-cranials regards the second phalanges and is presented in Fig. 10; the phalanx of K22 is longer but of comparable breadth as that of La Cannita 1.

In Fig. 11 two first lower molars of K22 hippo have been compared with Acquedolci and La Cannita 1 populations. The variables considered are the length and the posterior breadth. Unfortunately only few specimens were available; K22 sample is slightly smaller than Acquedolci but falls within the variability cloud of La Cannita 1. In Fig. 12 is shown one of the first lower molars of K22 sample.

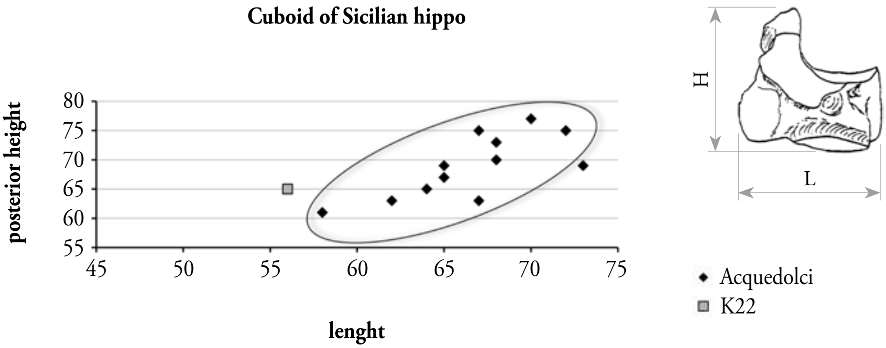

Fig. 8 – Scatter diagram that plots the length and the posterior height of hippos' cuboid from different Sicilian fossil sites.

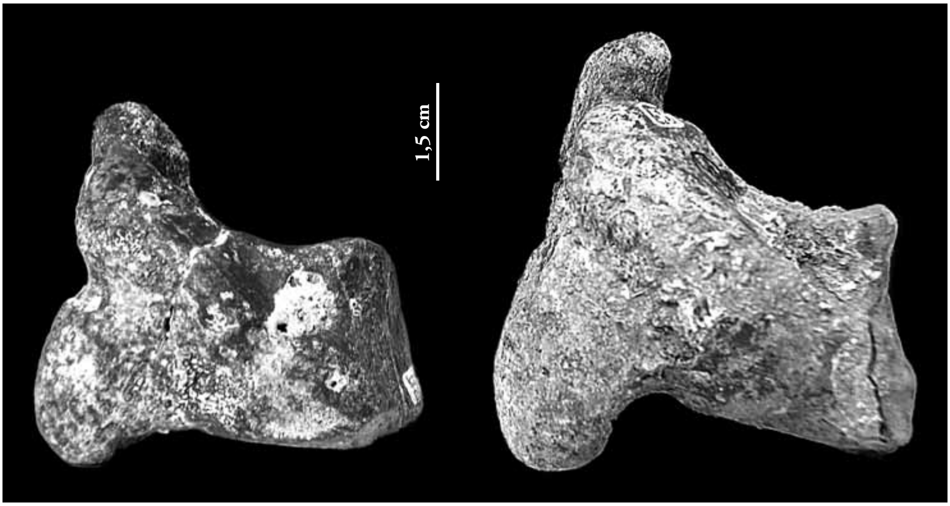

Fig. 9 – Photo of the comparison between the cuboid coming from Acquedolci (on the right) and that of K22 (on the left) in lateral view. Bar of 1,5 cm.

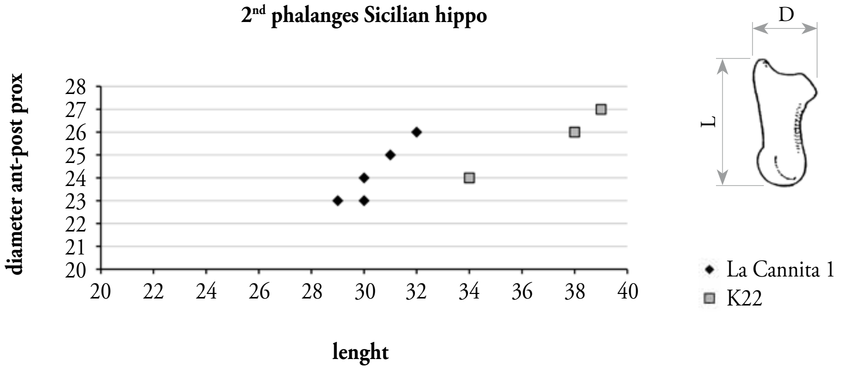

Fig. 10 – Scatter diagram that plots the maximal length and the diameter antero-posterior of proximal articular surface of hippos' second phalanges from different Sicilian fossil sites.

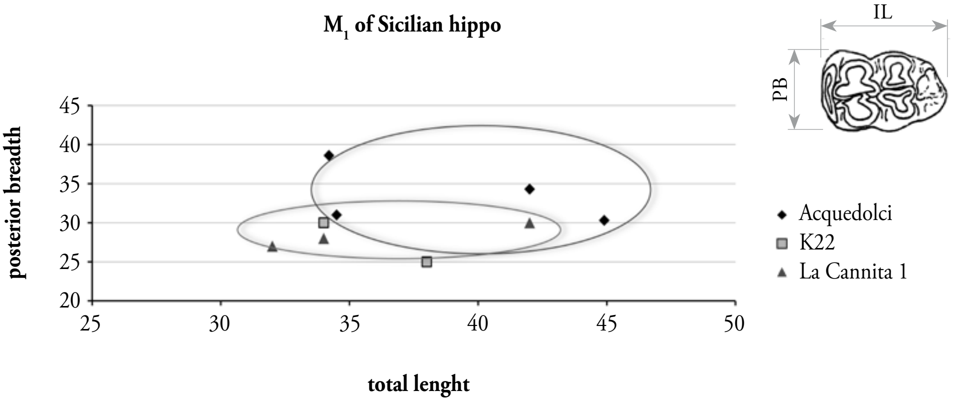

Fig. 11 – Scatter diagram that plots the total length and the posterior breadth of hippos' first lower molars from different Sicilian fossil sites.

Fig. 12 – Photo of the first lower molar of K22 hippo in occlusal view. Bar of 2 cm.

DISCUSSION AND CONCLUSIONS

Hippopotamus pentlandi from site K22, although represented by few specimens, shows important size differences, particularly in the postcranial skeleton, respect to the other Sicilian hippos. The comparison carried on with the available long and short bones of anterior and posterior limbs shows that the K22 hippo is the most reduced in size among the Sicilian specimens: it is well differentiated from the Acquedolci and Capo Tindari populations, which show the largest size, while is closer to La Cannita populations (1 and 2 in the graphs) even if slightly smaller. The only sample from San Ciro here examined, a tibia (Fig. 3), falls very close to K22. Such results are important notwithstanding the paucity of the hippo remains coming from K22 and their bad state of preservation.

The reduction of bones' size observed in K22 specimens is mostly dependent on the length of the bones and not particularly on the breadth of their articular surfaces. Both long and short bones, appear somewhat squat; and this proportion can be connected to some allometric reduction of limbs. This is only a suggestion since the sample is too small to reach a statistical significance.

Even the teeth show a reduction in size, but not so pronounced as the limb bones. The first lower molars fall within the range of La Cannita 1 sample close to the lower values of the Acquedolci population. The results suggest that the teeth, as well as the gnawing apparatus, underwent a reduction in size at a minor extent than the limb bones. This consideration might suggest that, while the reduction of body size is an advantage under scarce food supply or other unfavorable ecologic conditions, the same is not true for the reduction of the skull or of the gnawing apparatus. In this way the apparent disproportion between the teeth and limb size could have an adaptive meaning linked to a different adaptation acquired by K22 hippo.

Different hypothesis can explain such extent of size reduction observed for K22 hippo.

The small size could indicate that the hippo that inhabited San Vito lo Capo area, the westernmost hippo's fossil site in Sicily, underwent high selective pressures that provoked a morpho-functional alteration of limbs (Caloi & Palombo, 1994). Alternatively, the reduced size of K22 population among the other Sicilian hippo samples could be indicative of an older age of K22 deposit. However at the moment there is not any evidence of such ancient dispersal of hippos in the island. Further explanations, even if not completely alternative, could be related to the environment in which such hippo lived. Masini (1995) suggested that the reduction of hippo's size in the island could more have been an adaptive response to the life in densely forested environments, than an insular dwarfism following the so called "Island Rule" (Van Valen, 1973). Masini (1995) suggested that the size reduction of Sicilian's hippos could be the result of unfavorable ecologic conditions, like densely forested environments probably diffused on the island during the interglacials. Moreover, even the protraction of cold-arid climatic phases during Late Pleistocene reducing the extension and the amount of humid areas, the more favorable living habitats for hippos, could have provoked further size reduction.

The reconstruction of the paleo-environment in the neighboring of K22 site is rather difficult as the hippo remains come from two levels that filled a cavity, and they have been subjected to a certain water transport (as testified by the floating signs on the bone tissues) while the other Sicilian fossil hippos are found in the sites where, or close to where, they probably lived, such as pounds, swamps, small lakes, streams or small rivers. As a matter of facts, the greatest part of hippo remains come from lacustrine deposits outcropping in front of cavities

(Puntali, Acquedolci, la Cannita, Zà Minica, Amoroso, Capo Tindari) or from fluviatile deposits (Messina Formation, Rocca Scodonì, Comiso) or even from littoral deposits (San Ciro, Coste di Gigia).

Nowadays, because of the high position of K22 cavity close to the summit plain of Piana di Sopra, the site apparently lacks the morphological conditions that permit the existence of a local fresh water flow. It is more likely that the bones were transported from some nearby location. Although the relatively abundance of hippo remains would suggest the local presence of perennial water expanses; also such interpretation must be considered with caution, as in some islands hippos can develop more terrestrial attitudes (Sondaar & Braber, 1988). In fact the occurrence of the boar, and of two dormice in the upper level (Fig. 2) where some hippo bones have been collected, can indicate the presence of a dense forest cover in the area. Indeed, the geo-pedologic characteristics of the two levels were hippo fossil occur confirm that climate was warm-temperate during the deposition and the following pedogenesis of the sediments.

To get an idea of the life habitat of K22 fossil hippo is interesting to consider the preferred environments of extant hippos. The African large sized *Hippopotamus amphibius*, is strictly linked to water expanses and feeds in open spaces like savannah environments. The Liberian dwarf hippo *Choeropsis liberiensis,* conversely, is less dependant on water and is more adapted to forested environments. Being the latter more terrestrial, his diet and locomotion are different from that of the other hippo; he prefers herbaceous and broad-leaf plants and fruits and he is a digitigrades with more elongated phalanges adapted to harder substrata. The longest phalanges observed in K22 hippo (Fig. 10) could be a clue, to be interpreted with certain caution, of a convergent evolution with the extant Liberian dwarf hippo. This hypothesis that interpret the K22 hippo as more adapted to terrestrial-forested environment is congruent with the absence in the surroundings of the fossil site of evidences of ancient water expanses. An analogous conclusion was reached by Van der Geer et al. (2006) who considers the pigmy Cretan hippo (*Hippopotamus creutzburgi*) adapted to a rocky environment as evidenced by the high size reduction and by the digitigrades posture in respect to its continental forerunner *H. antiquus*.

APPENDIX

Appendix Bone and teeth biometric data coming from literature or unpublished thesis of different Sicilian samples and from measurements of K22 hippo's bones.

scaphoid	**Acquedolci** Capilli (1989-90		**La Cannita 1** Accordi (1955)		**K22**	
	Maximal length	Heigth	Maximal length	Heigth	Maximal length	Heigth
min	56	43	59	42	56	43
max	76	60	59	42	61	47
mean	63,65	50,88	59	42	57,86	45,43
n	40	44	1	1	7	7
SD	4,45	3,63			2,77	1,40

continued

tibia	**Acquedolci** Gareffa (1987-88)		**La Cannita 1** Accordi (1955)		**La Cannita 2** Capasso et al., 1983		**San Ciro** unpublished		**K22**	
	Maximal length	Proximal breadth	Maximal length	Proximal breadth	Maximal length	Proximal breadth	Maximal length	Proximal breadth	Maximal length	Proximal breadth
min	290	126	267	121	297	122	282	119	260	120
max	360	147	315	145	297	122	255	113	260	120
mean	332,44	138,30	294,83	133,44	297	122	318,00	126,00	260,00	120,00
n	9	10	12	9	1	1	5	5	1	1
SD	22,86	5,64	82,43	40,37			27,32	5,43		

calcaneus	**Acquedolci** Capilli (1989-90)		**La Cannita 1** Accordi (1955)		**K22**		**Capo Tindari** Caloi (1973)	
	Maximal length	Diameter tuberosity	Maximal length	Diameter tuberosity	Maximal length	Diameter tuberosity	Maximal length	Diameter tuberosity
min	156	43	59	42	56	43	56	43
max	189	60	59	42	61	47	61	47
mean	168,82	50,88	59	42	57,86	45,43	57,86	45,43
n	11	44	1	1	7	7	7	7
SD	9,31	3,63			2,77	1,40	2,77	1,40

cuboid	**Acquedolci** Capilli (1989-90)		**K22**	
	Length	Posterior heigth	Length	Posterior heigth
min	58	60	56	65
max	76	77	56	65
mean	67,54	68,23	56	65
n	24	13	1	1
SD	4,63	5,42		

2nd phalanges	**La Cannita 1** Capilli (1989-90		**K22**	
	Length	Diameter proximal	Length	Diameter proximal
min	29	23	34	24
max	31	25	39	27
mean	29,50	23,25	37,00	25,67
n	5	5	3	3
SD	1,14	1,30	2,63	1,50

Lower M_1	**La Cannita 1** Accordi (1955)		**Acquedolci** Brigandi (1996-97)		**K22**	
	Length	Diameter proximal	Length	Diameter proximal	Total length	Posterior breadth
min	32	27	34,2	24,6	34	25
max	42	30	44,9	38,6	38	30
mean	36,00	28,33	38,72	30,93	36,00	27,50
n	3	3	5	6	2	2
SD	5,29	1,53	4,68	5,05	2,83	3,54

RIASSUNTO

Nuovi dati sull'ippopotamo endemico siciliano (*Hippopotamus pentlandi)* del Pleistocene medio

Questo lavoro verte sullo studio sistematico e biometrico dei resti scheletrici e dentari dell'ippopotamo del tardo Pleistocene Medio-primo Pleistocene Superiore proveniente dal sito "K22" presso la Penisola di san Vito lo Capo (Trapani). Si tratta di materiale inedito in quanto i reperti in questione non sono mai stati studiati sistematicamente ma attribuiti all'ippopotamo solo su base qualitativa. I dati biometrici acquisiti sono stati messi a confronto con i dati relativi ad altri ippopotami della Sicilia orientale e centro-settentrionale al fine di evidenziare l'esistenza di differenze morfologiche e/o di taglia. Dall'analisi biometrica di comparazione è risultato che il taxon di K22 rappresenta l'ippopotamo di minori dimensioni; le ossa lunghe e brevi degli arti anteriori e posteriori si presentano tozze (corte ma con un diametro relativamente meno ridotto), mentre i denti presentano una riduzione meno marcata. Vengono presentate diverse ipotesi che cercano di spiegare una riduzione di taglia così spinta: un isolamento più protratto nell'area insulare di San Vito lo Capo; una età più antica del deposito ed infine, un adattamento ad un modo di vita meno acquatico.

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