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CATALOGUE

Lynx, n. s. (Praha), **45**: 97–138 (2014). ISSN 0024-7774 (print), 1804-6460 (online)

Revised catalogue of wild equids in the collection of the National Museum, Prague, and several other collections in the Czech Republic (Perissodactyla: Equidae)

Revidovaný katalog divokých zástupců koňovitých ve sbírce Národního musea v Praze a v dalších sbírkách v České republice (Perissodactyla: Equidae)

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received on 31 October 2014

Abstract. A commented list of specimens of wild equids deposited in the Czech collections is presented, based on a detailed survey across a large number of institutions (museums, zoos, castles, etc.). Three collections were recognised as the most important; National Museum, Prague (NMP), Hippological Museum, Slatiňany (HMS) and the Dvůr Králové Zoo (DKZ). The revised collections contain 275 specimens of wild equids, which belong to seven species and seven subspecies. Two collections (NMP, DKZ) contain many captive born individuals of wild equids which could be regarded as valuable for detection of some captivity-induced changes in their somatic characters as well as calibration of some archaeological measures of the domestication processes in equids. The NMP, HMS and Prague Zoo collections contain numerous specimens of *Equus przewalskii* of the B-Line. The type specimen of *Asinus hemionus kulan* Groves et Mazák, 1967 is deposited in the NMP collection. Most of the here listed specimens are of a significant scientific value.

Key words. Przewalski horse, kulan, museum collections, captivity, catalogue.

INTRODUCTION

Horses (Equidae, Hippomorpha) represent a sister lineage to tapirs and rhinoceroses and their extinct relatives (Ceratomorpha) (Willoughby 1974, Price & Bininda-Emonds 2009, Steiner & Ryder 2011). They have produced a variety of more or less peculiar forms since the Eocene,

This catalogue is dedicated to Professor František Bílek who established the tradition of breeding of Przewalski horses in Czechoslovakia.

but their current diversity represents only a small remnant of their former diversity (e.g. Janis 1976, Franzen 1984, Forstén 1988a, 1989). On the other hand, extant species belong to several different lineages, possessing specific morphological, chromosomal, genetic, and behavioural features (e.g. Groves 1974, 1986, Groves & Willoughby 1981, Eisenmann 1986, Groves & ryder 2000, Oakenfull et al. 2000, Trifonov et al. 2008). The extant diversity of equids has a similar level as that of ceratomorphs (Groves & Grubb 2011), viz. eleven recognised equid species vs. ten ceratomorph (tapirs and rhinoceroses) species. The equids also belong to favorite flagship mammalian species from the conservation point of view; despite their significant plasticity in ecological requirements, several equid taxa became extinct and several others are endangered (see e.g. Groves 1974, Moehlman 2002).

Several equid taxa have been saved from extinction (e.g. Przewalski horse, Cape mountain zebra, Somali wild ass) using an active conservation management in captivity or in protected areas in the wild. Additionally, several rare equid taxa are kept in captivity using scientific--based management tools (cf. Frankham et al. 2002, Allendorf & Luikart 2007, Witzenberger & Hochkirch 2011). For example, prosperous populations of *Equus przewalskii*, *E. africanus somaliensis*, *E. kiang holdereri*, *E. hemionus kulan*, *E. h. onager*, *E. hartmannae*, and *E. grevyi* live in European institutions covered by the European Association of Zoos and Aquaria (EAZA). Unfortunately, this does not concern all threatened taxa, e.g. the breeding of *E. quagga borensis* stagnates due to a small number of available invidividuals and lack of interest to breed this taxon (Richard Østerballe & Lubomír Melichar, pers. comm.).

The zoological gardens in the Czech Republic have been active in breeding of wild equids for a long time (of the above mentioned taxa, only *Equus hemionus onager* had no breeding history in these zoos). Breeding of some African equids has a connection with the exceptional and successful transports of African ungulates to the Dvůr Králové Zoo in the 1960s and 1970s (see e.g. Vágner 1973). The geographical position of the zoos in Czechoslovakia in the transition stop between the west- and east-European countries and the good results of the Przewalski horse breeding have had positive effects on keeping of the rare equids (see e.g. Veselovský & Volf 1964). The Prague Zoo is one of the most important breeders of the Przewalski horse in the world (along with the Hellabrunn Zoo in Munich and Askania Nova Reserve; Boyd 1994). Additionally, the Prague Zoo has been keeping and publishing the *International Studbook of the Przewalski Horse* since 1960 (Kůs 2010). The staff of some zoological gardens in the Czech Republic recognised the importance of carcasses of zoo animals and as a result, several valuable specimens from the zoo breeding programmes are deposited in museum collections.

Considering the above mentioned factors, one could expect equids to be well represented in museum collections in the Czech Republic. Two large collections of equids are housed in the National Museum, Prague, and in the Hippological Museum, Slatiňany, some additional valuable specimens are located also in other institutions in the Czech Republic (see below). However, only the collections of the National Museum, Dvůr Králové Zoo, Protivín Museum, and the Hippological Museum comprise series of wild equids from captivity, other collections consist of isolated specimens obtained from the wild.

Selected data on equids from collections in the Czech Republic were published in several reports (Volf 1965, Heráň 1966, 1968a, b, Štěpánek 1975, Havlíček 2000, Spasskaya 2000, Hanák et al. 1999, 2003, Hanák 2005, Volf 2010a, b, Volf 2011). However, these publications do not present the complete lists of specimens of equids housed in the respective collections.

The catalogues of preserved material of equids (e.g. Volf 1965, Spasskaya 2000, Oriani & Castiglioni 2003, Zharkikh & Yasynetska 2007, 2009) are of great importance, since they

make the scientific work much more efficient. Here, we list the material of wild equids stored in the National Museum, Prague, and several other collection in the Czech Republic (cf. Robovský et al. 2010), with the only exception of the whole equid collection of the Hippological Museum, Slatiňany, that is commented in details elsewhere (Robovský et al. 2014).

MATERIAL AND METHODS

We attempt to identify, verify or comment on collection specimens primarily deposited in the National Museum, Prague, and all additional specimens deposited in several other collections (see the abbreviations below). We addressed all institutions (museums, castles, zoos, etc.) in the Czech Republic, which might store such material, and surveyed all available collection catalogues/reports as specified in Robovský et al. (2010); see also Mlíkovský et al. (2011a, b). The first author (JR) also attempted to visit all respective institutions, but some isolated specimens across various small collections remain personally unrevised.

Species/subspecies identity was (re-)determined by the first author (JR) according to the following literature and all information associated with the specimens, viz. Cooke (1943), Gromova (1959), Trumler (1959), Frechkop (1965), Azzaroli (1966), Groves et al. (1966), Frechkop (1967), Groves & Mazák (1967), Eisenmann & de Guili (1974), Gentry (1975), Eisenmann (1976), Bennet (1980), Groves & Willoughby (1981), Penzhorn (1988), Thackeray (1988), Churcher (1993), Groves (1994), Klein & Cruz-Uribe 1996, Eisenmann & Churcher 1997, Eisenmann 2002, Groves 2002, Eisenmann 2006, Grinder et al. 2006, Müller & Wussow 2010.

We operationally define "normal condition" for skulls as follows: (adult) skull is complete (skull and mandible), undamaged, without roughening in the diastema region (score 0, see Bendrey 2007a), a normal dental formula with no wolf teeth (rudimentary first upper premolars; Groves & Mazák 1967) present, and the teeth are undamaged or of the normal shape; for metapodials as: no apparent evidence of ossification of the ligaments between the metapodials (see Bendrey 2007b); for skins as: complete undamaged skin with complete head, tail and hooves. We only note exceptions from these states and other unusual conditions in the basic description of the respective specimens. The diastema region and ossification of the ligaments between the metapodials is scored according to the system by Bendrey (2007a, b); where the level of ossification of particular ligaments varies within a specimen, the most advanced score observed is specified. The number of supra-orbital foramina (Eisenmann 1986) and the presence of canines and their relative size (very small / small / large) are specified for all specimens (Vollmerhaus et al. 2003). The state of the infundibulum of the lower incisors (see Bennett 1980) is specified for plains zebra specimens (Groves & Bell 2004), and the anterior enamel/dentine exposures and bevel measurements (see Bendrey 2007a, and also Anthony & Brown 1991) are specified for Przewalski horse specimens not included in Bendrey (2007a). All characters (diastema region, wolf teeth, supra-orbital foramina, canines, infundibulum, enamel/dentin exposures and bevel) were scored only for adults, i.e. the specimens with closed sutures in the skull basis and erupted third molars and/or fused epiphyses in postcranial bones.

We attempt to specify the age of all specimens based on the available data or the dental criteria estimation proposed by King (1965), Klingel & Klingel (1966), Joubert (1972), Smuts (1974), Červený et al. (1999), Ansorge et al. (2007), and Lkhagvasuren et al. (2013); for review see also Klevezal (2007). Two systems of age determination based on dental criteria were used for skulls without detailed information, one proposed originally for the domestic horse (Červený et al. 1999) and another one used for closely related taxa with an available age determination system (Klingel & Klingel 1966, Joubert 1972, Smuts 1974).

The category of "fox horses" is specified for Przewalski horse specimens, as "Ee" for the fox gene carrier and as "ee" for the fox gene missing (red coloured horse, sorrel), in accordance with the *International Studbook of the Przewalski Horse* (Kůs 2010). The recognised breeding lines (A, B, M) are specified for the Przewalski horse specimens (cf. Zimmermann 2009), A/B-Line is associated with the genetic influence of Horymír and his male offspring in the Old Prague line (B-Line) horses.

In the catalogue, basic description of the specimens is provided first, the available information on the origin of the respective specimen, original description and notes (mostly translated from Czech to Eng-

lish) filled under Origin (**O**) and different specific notes (species/subspecies and age determination, some additional observations or speculations) filled under Notes (**N**). If the identification is only approximate, the uncertainty is stressed (cf.).

Although several measurements were taken for the determination of equid taxa, only three of them are presented, viz. condylobasal length (= aboral border of the occipital condyles – prosthion), greatest breadth of skull and mandible length (= the most aboral borders of condyles processes – infradentale); generally, in accordance with VON DRIESCH (1976). The dimension values are given in millimetres.

In some cases, an exact value of the standard measurements could not be obtained due to the preservation state of the specimen (e.g. damages, mobility of some regions) and/or inaccessibility (e.g. permanent fixation of mandible to the skull, logistic inaccessibility). If some measurements are only approximate, the uncertainty is stressed (~).

The taxonomic arrangement follows GROVES & GRUBB (2011).

ABBREVIATIONS

COLLECTIONS (in the order of their use in the catalogue per species account). NMP – National Museum (Natural History), Prague (collection numbers with prefices 'P6V'; for details see e.g. ŠTĚPÁNEK 1975); HMS – Hippological Museum, Slatiňany (for details see HAVLÍČEK 2000, GOTTHARDOVÁ & BÍLEK 2012); DKZ – Dvůr Králové Zoo. The first and second authors personally visited all these collections and attempted to document, measure and revise all specimens.

OTHERS. a.n. – accessite number; (D) – right (side); (S) – left (side); CL = condylobasal length; GB = greatest breadth of skull; ML = mandible length (for definitions see above); HNa = house name; SNa = studbook name; SNr = studbook number; * = born; † = died; CR = Czech Republic.

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Equus przewalskii Polâkov, 1881

NMP 10649; complete skull, pelvis, scapulae, long limb bones; complete skin, hooves absent. Left side of the braincase cracked, diastema formation 1 (BENDREY 2007a); ossification of ligaments between the metapodials: 1c (BENDREY 2007b); one supra-orbital foramen on both sides. Canines large. Anterior enamel/dentine exposures 0; bevel 0 (both according to BENDREY 2007a). CL~485, GB=196, ML=410. **O**: *Equus przewalskii* ♂, skin obtained on 16 September 1957, skull in 1988, a.n. 7741/V.; Prague Zoo, n. 3824, 1957, SNr 83, SNa Praha 16, HNa Ajak, * 18 May 1953, † 15 September 1957. **N**: *E. przewalskii*. A/B-Line. The skin originally numbered as NMP 40728.

NMP 15687; complete skull; complete skin, hooves absent. Very advanced tooth wear, cheektooth rows vary in their height markedly, upper cheektooth rows consist of only rudiments of former teeth. Diastema formation 1 (BENDREY 2007a); wolf tooth ?; one supra-orbital foramen on both sides. Canines absent. Anterior enamel/dentine exposures ~8.45 (EDH), 3 (EDW); bevel 3,5 (BENDREY 2007a). CL=522, GB=216, ML=436. Several naked places on the skin (probably due to advanced age of this individual). **O**: *Equus przewalskii* ♀, a.n. 6/2007; Prague Zoo, SNr 511, SNa Praha 108, HNa Cilka, * 21 March 1972, † 12 August 2006. **N**: *E. przewalskii*. Some postcranial bones with marked pathological changes (arthrosis). A/B-Line. The skin originally numbered as NMP 58311.

NMP 22770; complete juvenile skull (first molars starting the eruption). CL=350, GB=158, ML=298. **O**: *Equus przewalskii* ♂, 25 August 1974, a.n. 5/75; Prague Zoo, SNr 583, SNa Praha 115, HNa Eben, * 11 May 1974, † 23 August 1974. **N**: *E. przewalskii*, A/B-Line.

NMP 22771; complete juvenile skull (second molars erupting) and postcranial skeleton. CL=481, GB=194, ML=405. **O**: *Equus przewalskii* ♂, 22 November 1959, a.n. 121/59; Prague Zoo, SNr 97, SNa Praha 30, HNa Milan, * 26 June 1958, † 19 November 1959. **N**: *E. przewalskii*, A/B-Line.

NMP 22772; complete skull and postcranial skeleton, very advanced tooth wear, second and third upper molars and third lower molars are very high and suppress counterpart teeth and also mandible. Wolf tooth on both sides, one supra-orbital foramen on both sides. Canines absent. CL=487, GB=215, ML=412. **O**: *Equus przewalskii* ♀, 10 January 1962, a.n. 11/62; Prague Zoo, SNr 72, SNa Praha 5, HNa Heluš, * 21 March 1933, † 10 January 1962. **N**: *E. przewalskii*, B-Line, Ee. Some postcranial bones with marked pathological changes (arthrosis).

NMP 24688; complete skull and postcranial skeleton; mounted skin. Very advanced tooth wear (cheek-tooth rows vary in their height markedly), one round hole (abscess?) above second upper premolar (D), several teeth absent – first upper incisor (S), second upper premolar (D), third lower molar (D). Number of supra-orbital foramina: 2(S)/1(S). Canines large (upper canine (D) undeveloped at all). CL=507, GB=217, ML=428. **O**: *Equus przewalskii* ♂, 11 July 1974, a.n. 52/74; Prague Zoo, SNr 76, SNa Praha 9, HNa Uran, * 27 May 1944, † 11 July 1974. **N**: *E. przewalskii*. A/B-Line. Some postcranial bones with pathological changes (arthrosis). The skin originally numbered as NMP 14221.

NMP 46507; scapulae and long limb bones; complete skin, hooves absent. Ossification of ligaments between the metapodials: 2 (Bendrey 2007b). **O**: *Equus przewalskii* ♂, skin in bad condition; 25 July 1944, a.n. 6333/44; Prague Zoo, SNr 120, SNa Washington 1, HNa Horymír, * 21 July 1930, † 25 July 1944. **N**: *E. przewalskii*. Spasskaya (2000) associated the skin of the Przewalski horse in HMS (48/50) with Horymír, but all skins of the Przewalski horse stored in the HMS belong to other individuals (our findings); skull not localised (Volf 2010b), A-Line, Ee. The skin originally numbered as NMP 12774.

NMP 46585; complete skull, postcranial skeleton and hooves; complete skin without hooves. One supra-orbital foramen on both sides. Wolf tooth – only alveoli are present on both sides. Canines very small – absent. CL=510, GB=215, ML=430. **O**: *Equus przewalskii* ♀, 17 May 1977, a.n. 51/77; Prague Zoo, SNr 471, SNa Praha 100, HNa Artemis, * 23 May 1970, † 16 May 1977. **N**: *E. przewalskii*. The skull was not localised by Volf (2010b). Coronoid processes abraded at their apices. A/B-Line. The skin originally numbered as NMP 36723.

NMP 47160; complete skull, first upper incisor (D) and second and third premolars (S) isolated. One supra-orbital foramen on both sides. Canines very small – absent. CL=492, GB=226, ML=419. **O**: *Equus przewalskii* ♀, 24 November 1984, leg. J. Volf, a.n. 51/93; Prague Zoo, SNr 273, SNa Praha 48, HNa Hera, * 9 May 1962, † 24 November 1984. **N**: *E. przewalskii*. A/B-Line, Ee.

NMP 47161; complete skull. Wolf tooth present on both sides; one supra-orbital foramen on both sides. Canines very small – absent. Anterior enamel/dentine exposures (approx.) 6.16 (EDH), 2.5 (EDW); bevel 1.5 (Bendrey 2007a). CL=492, GB=217, ML=417. **O**: *Equus przewalskii* ♀, 21 May 1976, leg. J. Volf, a.n. 51/93; Prague Zoo, SNr 488, SNa Praha 105, HNa Balada, * 27 April 1971, † 21 May 1976. **N**: *E. przewalskii*, A/B-Line.

NMP 47162; complete juvenile skull (second molars erupted, third molars in evidence). CL=495, GB=205, ML=412. **O**: *Equus przewalskii* ♂, 17 May 1966, leg. J. Volf, a.n. 51/93; Prague Zoo, SNr 323, SNa Praha 66, HNa Vikomt, * 1 October 1964, † 17 May 1966. **N**: *E. przewalskii*, A/B-Line.

NMP 47163; complete juvenile skull (second molars erupted, third molars in evidence) and one hyoid bone, three incisors and two cheekteeth isolated; complete skin, hooves absent, dark belly. CL=475, GB=192, ML=398. **O**: *Equus przewalskii* ♀, 21 July 1969, leg. J. Volf, a.n. 51/93 & 55/93; Prague Zoo, SNr 363, SNa Praha 80, HNa Vlha, * 7 October 1966, † 21 July 1969. **N**: *E. przewalskii*. A/B-Line. The skin originally numbered as NMP 52909.

NMP 47164; complete juvenile skull (second molars fully erupted, third molars in evidence). CL=507, GB=214, ML=423. **O**: *Equus przewalskii* ♂, 9 November 1988, leg. J. Volf, a.n. 51/93; Prague Zoo, SNr 1360, SNa Praha 139, HNa Patrik, * 5 June 1985, † 5 October 1988. **N**: *E. przewalskii*, A/B-Line.

NMP 47165; complete skull, third upper incisor (S) absent. One supra-orbital foramen on both sides. Canines small – absent. CL=504, GB=218, ML=424. **O**: *Equus przewalskii* ♀, 17 March 1982, leg. J. Volf, a.n. 51/93; Prague Zoo, SNr 850, SNa Praha 39, HNa Háta, * 3 June 1960, † 17 March 1982. **N**: *E. przewalskii*, A/B-Line.

NMP 47166; incomplete juvenile skull (only premolars erupted), left mandible absent, upper rostrum broken. CL~279, GB=119, ML>250. **O**: *Equus przewalskii* ♀, 7 May 1962, leg. J. Volf, a.n. 51/93; Prague Zoo, SNr 270, SNa Praha 46, * 4 May 1962, † 7 May 1962. **N**: *E. przewalskii*, A/B-Line.

NMP 47167; complete skull; complete skin, hooves absent, light colouration. Frontal and interorbital regions with two cracks, basal part of the braincase absent, crack in the orbit region (S), fourth lower premolars (D) absent. Number of supra-orbital foramina: 1(S)/3(D). Canines absent. CL=496, GB=199, ML=425. **O**: *Equus przewalskii* ♀, 6 September 1964, leg. J. Volf, a.n. 51/93 & 55/93; Prague Zoo, SNr 74, SNa Praha 7, HNa Lucka, * 1 July 1941, † 6 November 1964. **N**: *E. przewalskii*. A/B-Line, ee. The skin originally numbered as NMP 52907.

NMP 47168; complete juvenile skull (first molars finishing the eruption, second molars in evidence), two upper and three lower incisors absent. CL=475, GB=192, ML=399. **O**: *Equus przewalskii* ♂, 21 August 1968, leg. J. Volf, a.n. 51/93; Prague Zoo, SNr 376, SNa Praha 84, HNa Hubert, * 3 June 1967, † 21 August 1968. **N**: *E. przewalskii*, M-Line. Angulus mandibulae (D) robust.

NMP 47169; complete juvenile skull (first molars fully erupted, second molars in evidence) and partial remains of hyoid bone. CL=465, GB=192, ML=392. **O**: *Equus przewalskii* ♂, 21 July 1969, leg. J. Volf, a.n. 51/93; Prague Zoo, SNr 395, SNa Praha 90, HNa Vír, * 3 June 1968, † 21 July 1969. **N**: *E. przewalskii*, M-Line.

NMP 47170; complete juvenile skull (second molars finishing the eruption), first upper incisors absent, two holes in orbit (D). CL=486, GB=199, ML=409. **O**: *Equus przewalskii* ♂, 13 February 1967, leg. J. Volf, a.n. 51/93; Prague Zoo, SNr 337, SNa Praha 73, HNa Vasal, * 9 June 1965, † 13 February 1967. **N**: *E. przewalskii*, A/B-Line.

NMP 47171; complete skull, first upper incisor (S) absent, mandible broken in two halves, palatal region with cut away narrow stripe from incisive foramen to choanae, part of the braincase absent. Number of supra-orbital foramina: one foramen on both sides. Canines: absent. CL×, GB~216, ML=440. **O**: *Equus przewalskii* ♀, 23 June 1965, leg. J. Volf, a.n. 51/93; Prague Zoo, SNr 96, SNa Praha 29, HNa Vida, * 14 June 1958, † 23 June 1965. **N**: *E. przewalskii*. Abscess on the lingual side of the left mandible (in front of second premolar), A/B-Line.

NMP 47173; complete skull; complete skin, hooves absent. One supra-orbital foramen on both sides. Canines very small – absent. CL=500, GB=221, ML=424. **O**: *Equus przewalskii* ♀, 7 December 1975, leg. J. Volf, a.n. 51/93 & 219/2003; Prague Zoo, SNr 403, SNa Praha 94, HNa Helada, * 22 February 1969, † 7 December 1975. **N**: *E. przewalskii*. A/B-Line. The skin originally numbered as NMP 57187.

NMP 47418; complete juvenile skull (third molars starting the eruption); complete skin, hooves absent. CL=347, GB=150, ML=292. **O**: *Equus przewalskii* ♂, 1 May 1982, a.n. 219/2003, Prague Zoo, SNr 862, SNa Praha 129, HNa Juno, * 8 September 1979, † 1 May 1982. **N**: *E. przewalskii*. Incorrect sex specification (♀ in fact). White star on the forehead. M-Line. The skin originally numbered as NMP 57184.

NMP 48198; complete skull, hyoid bones, pelvis, limb bones, sacrum, several vertebrae, hooves; incomplete skin (head only). Dorsal part of the braincase cut away. Ossification of ligaments between the metapodials: 1c (Bendrey 2007b), one supra-orbital foramen on both sides. Canines very small – absent. CL=503, GB=206, ML=427. **O**: *Equus przewalskii* ♀, 10 December 1998, a.n. 87/98 & 103/2011; Prague Zoo, SNr 1086, SNa Praha 133, HNa Mona, * 7 August 1982, † 1 December 1998. **N**: *E. przewalskii*. M-Line, Ee. The skin originally numbered as NMP 60555.

NMP 48278; complete skull, scapulae, long limb bones. Wolf tooth present (S), two supra-orbital foramina on both sides. Canines medium-sized. CL~501, GB=198, ML=428. **O**: *Equus przewalskii* ♂, 13 May 1999, a.n. 85/99; Prague Zoo, SNr 2500, SNa Praha 184, HNa Yper, * 26 June 1993, † 13 May 1999. **N**: *E. przewalskii*, M-Line.

NMP 48351; complete skull, hyoid bones, pelvis (asymetric), sacrum, long limb bones; very advanced tooth wear (second and third upper molars abraded by lower molars, third lower molars without such advanced tooth wear in the lower cheektooth row. One supra-orbital foramen on both sides. Canines absent. CL=508, GB=210, ML=424. **O**: *Equus przewalskii* ♀, 23 June 1999, a.n. 87/99; Prague Zoo, SNr 481, SNa Praha 102, HNa Afrodite, * 7 August 1970, † 23 June 1999. **N**: *E. przewalskii*, M-Line.

NMP 48756; complete skull, hyoid bones and postcranial skeleton; very advanced tooth wear, second upper premolar (D) absent. Number of supra-orbital foramina: one foramen on both sides. Canines: absent. CL=503, GB=218, ML=431. **O**: *Equus przewalskii* ♀, 1 May 2000, a.n. 79/2000; Prague Zoo, SNr 492, SNa Praha 106, HNa Bára, * 17 May 1971, † 1 May 2000. **N**: *E. przewalskii*, M-Line. Bone loss is observable in some postcranial bones (e.g. vertebrae).

NMP 49009; complete skull and hyoid bones, pelvis with sacrum and limb bones, several vertebrae; second upper incisor (S) deformed. Number of supra-orbital foramina: one foramen on both sides. Canines: large. CL=505, GB=207, ML=424. **O**: *Equus przewalskii* ♂, 27 October 2000, a.n. 10/2001; Prague Zoo, SNr 2402, SNa Praha 176, HNa Xerox, * 26 October 1992, † 26 October 2000. **N**: *E. przewalskii*, M-line.

NMP 52908; skin; hooves, limbs and tail absent. **O**: *Equus przewalskii* ♂, 5 June 1967, leg. J. Volf, a.n. 55/93; Prague Zoo, SNr 78, SNa Praha 11, HNa Oskar, * 4 July 1950, † 5 June 1967. **N**: *E. przewalskii*, A/B-Line.

NMP 52910; complete skin, dark nose. **O**: *Equus przewalskii* ♂, 5 November 1959, a.n. 55/93; Prague Zoo, SNr 92, SNa Praha 25, HNa Leo, * 5 May 1957, † 5 November 1959. **N**: *E. przewalskii*. Skin somewhat damaged on the head, A/B-Line. The associated skeleton could be localised in the collection of the Czech University of Life Sciences according to the collection evidence; however, Volf (2010b) suggested it was transfered to the HMS. We concur with the latter possibility based on our survey of HMS.

NMP 52911; complete skin. **O**: *Equus przewalskii* ♂, 13 November 1965, leg. J. Volf, a.n. 55/93; Prague Zoo, SNr 291, SNa Praha 55, HNa Vezir, * 13 June 1963, † 13 September 1965. "Dark type". **N**: *E. przewalskii*, A/B-Line.

NMP 52912; skin, hooves and tail absent. **O**: *Equus przewalskii* ♀, 25 April 1970, a.n. 55/93; Prague Zoo, SNr 463, SNa Praha 98, * 18 April 1970, † 25 April 1970. **N**: *E. przewalskii*, M-Line.

NMP 57176; complete skin, hooves absent. **O**: *Equus przewalskii* ♀, 22 April 1992, a.n. 219/2003; Prague Zoo, SNr 1035, SNa Praha 137, HNa Pavlína, * 6 February 1985, † 22 April 1992. **N**: *E. przewalskii*, M-Line.

NMP 57189; skin, hooves and tail absent. **O**: *Equus przewalskii* ♀, 25 January 1973, a.n. 219/2003, Prague Zoo, SNr 86, SNa Praha 19, HNa Vesna, * 17 May 1954, † 25 January 1973. **N**: *E. przewalskii*, A/B-Line.

NMP 90194; complete skull and hyoid bones, postcranial skeleton; mounted skin. Number of supra-orbital foramina: one foramen on both sides. Canines: large. CL=493, GB=211, ML=409. **O**: *Equus przewalskii* ♂, 3 September 2001, a.n. 144/2001; Prague Zoo, SNr 1325, SNa Midway 13, HNa Danny Boy, * 4 May 1985, † 3 September 2001 (euthanasia); the skin mounted by M. Malucha (Ostrava) in 2002. **N**: *E. przewalskii*. M-Line. The skin originally numbered as NMP 56772.

NMP 90195; complete skull and postcranial skeleton; complete skin. Number of supra-orbital foramina: 2(S)/1(D). Canines: large. CL=513, GB=214, ML=430. **O**: *Equus przewalskii* ♂, 9 September 2001, a.n.

Fig. 1. Very advanced tooth wear in *Equus przewalskii* (NMP 95180).
Obr. 1. Silný obrus stoliček u koně Převalského (*Equus przewalskii*; sbírka Národního musea v Praze [NMP], č. 95180).

144/2001; Prague Zoo, SNr 2169, SNa Bratislava 4, HNa Martin, * 8 May 1991, † 6 September 2001 (euthanasia), prepared by M. Malucha (Ostrava) in 2005; hybrid features. **N**: *E. przewalskii*. M-Line. The skin originally numbered as NMP 57602.

NMP 90200; complete skull, hyoid bones, pelvis, sacrum, several vertebrae, advanced tooth wear (second upper premolars, third upper molars). Number of supra-orbital foramina: several foramina on both sides (3). Canines: absent. CL=515, GB=212, ML=435. **O**: *Equus przewalskii* ♀, 22 November 2004, a.n. 28/2005; Prague Zoo, SNr 1127, SNa Praha 134, HNa Nora, * 16 May 1983, † 22 November 2004. **N**: *E. przewalskii*, M-Line.

NMP 95116; complete (winter) skin, hooves absent. **O**: *Equus przewalskii* ♀, 16 February 1930, a.n. 3936/30; purchased alive from Hagenbeck, Hamburg, for the Agricultural University in Prague; the skin was donated to the National Museum, via Professor František Bílek, in exchange for mounting of two Qarakul sheep lambs and one Przewalski horse foal for the respective university. **N**: *E. przewalskii*.

NMP 95180; complete skull, very advanced tooth wear, one round hole in the frontal region. Number of supra-orbital foramina: 2 (S)/1(D). Canines absent (one minute is present in the mandible (D)). Anterior enamel/dentine exposures 0; bevel 0 (both according to Bendrey 2007a). CL=527, GB=224, ML=451. **O**: *Equus przewalskii* ♀, a.n. 99/2014; Prague Zoo, SNr 1313, HNa Petra, * 12 April 1985, † at 29 years; **N**: *E. przewalskii*, M-Line, Ee (Fig. 1).

NMP 95181; complete juvenile skull (first molars erupting). CL=459, GB=194, ML=384. **O**: *Equus przewalskii* ♂, a.n. 99/2014; Prague Zoo, SNr –, SNa Slatiňany 8, HNa Octavian, * 10 April 2013, † 2 June 2014 (killed in a stallion group). **N**: *E. przewalskii*, M-Line.

Equus africanus somaliensis Noack, 1884

NMP 47326; complete skull and hyoid bones, postcranial skeleton and hooves. Diastema formation: 2? (Bendrey 2007a); number of supra-orbital foramina: one foramen on both sides. Canines: medium-sized. CL>454, GB=194, ML=386. **O**: *Equus africanus somaliensis*, 7 April 1990, n. 35, a.n. 24/94; Ústí nad Labem Zoo (* Tierpark Berlin), age – 2 years. **N**: *E. africanus somaliensis*. The first cervical vertebra is fused with the skull (Fig. 2).

NMP 95182; complete skull and skeleton. Number od supra-orbital foramina: one foramen on both sides. Canines: large. Greatest skull length = 528, GB=213. Ossification of ligaments between the metapodials: 2 (Bendrey 2007b). **O**: *Equus africanus somaliensis* ♂, a.n. 99/2014; Dvůr Králové Zoo, HNa Quoray * 10 July 1990 (Oberwil Zoo, Basel, Switzerland), † 19 March 2012 (Dvůr Králové Zoo); **N**: *E. africanus somaliensis*, two small round and elevated holes are present in the postorbital region, posterior margin of the right orbit fractured and healed.

NMP 95183; complete skull and skeleton; complete skin. **O**: *Equus africanus somaliensis* ♂, a.n. 99/2014; Liberec Zoo, HNa Marko, * 30 July 1991 (Tierpark Berlin, Germany), † 21 October 2013 (Liberec Zoo); **N**: *E. africanus somaliensis*.

Equus kiang holdereri Matschie, 1911

NMP 21893; complete skull; mounted skin. Robust nasal region, sagital crest extended laterally on the left side, postcranial skeleton (limb bones). Diastema formation: 1? (Bendrey 2007a); ossification of

Fig. 2. Fusion of the first cervical vertebra with the skull in *Equus africanus somaliensis* (NMP 47326).
Obr. 2. Srůst prvního krčního obratle a lebky u osla somálského (*Equus africanus somaliensis*; NMP 47326).

Fig. 3. Skull of *Equus kiang holdereri* of the Prague Zoo breeding programme (NMP 92786).
Obr. 3. Lebka kianga (*Equus kiang holdereri*) z chovu pražské zoologické zahrady (NMP 92786).

ligaments between the metapodials: 1c–2 (Bendrey 2007b), number of supra-orbital foramina: several (minute) foramina on both sides. Canines: large. CL=493, GB=209, ML=423. **O**: *Equus hemionus kiang* ♂, 30 March 1971, 6291, a.n. 21/73 & 85/77; Prague Zoo, * 1960 (Riga Zoo, USSR [= Riga, Latvia]), † 26 March 1971 (Prague Zoo). An offspring of the parents imported from the Kukunor Lake region (Tibet). **N**: *E. kiang holdereri*. The skin originally numbered as NMP 36724.

NMP 59805; complete skin, hooves absent. **O**: *Equus kiang* ♀, 30 October 2006, a.n. 75/2009; Prague Zoo, SNr 60, SNa Riga 38, HNa Riga, * 29 June 1984, † 30 October 2006. **N**: *E. kiang holdereri*.

NMP 92786; complete skull; complete skin. Number of supra-orbital foramina: two foramina on both sides. Canines: large. CL=506, GB=200, ML=436. **O**: *Equus kiang holdereri* ♂, 27 August 2009, a.n. 31/2010; ARKS 220146, SNr 241 (Praha 9), * 10 July 2002 (Prague Zoo), † 27 August 2009 (euthanasia, Prague Zoo). **N**: *E. kiang holdereri*. The skin originally numbered as NMP 59994 (Fig. 3).

Equus hemionus kulan (Groves et Mazák, 1967)

NMP 10698; complete skull, rostrum cracked (ahead of cheektooth row) (S); mounted skin, winter coat, one naked spot on the back. Diastema formation: 2 (Bendrey 2007a). Canines: large. For skull measurements see Groves & Mazák (1967) and Volf (2010a). **O**: *Equus hemionus kulan* ♂, 18 January 1962, a.n. 21/62, n. 3874; Prague Zoo, arrival 10 May 1961 (caught in the Badhyz Reserve, Turkmenistan), † 18 January 1962, SNr 17, age 5–6 years (4 years 6 months – Volf 2010a). **N**: *E. hemionus kulan*. Holotype of *Asinus*

hemionus kulan Groves et Mazák, 1967 (for more details and photographs see also Groves & Mazák 1967, Volf 2010a, Mlíkovský et al. 2011a). The skull originally numbered as NMP 10699 (Fig. 4).

NMP 25960; complete skull; complete skin, hooves absent. Number of supra-orbital foramina: 1(S)/3(D). Canines: medium-sized. For skull measurements see Volf (2010a). **O**: *Equus hemionus kulan* ♂, 13 March 1979, leg. J. Volf, a.n. 8/79; Prague Zoo, SNr 188, age – 9 years, an offspring of the parents caught in the Badhyz Reserve (Turkmenistan), † 13 March 1979. **N**: *E. hemionus kulan*. The skin originally numbered as NMP 37452.

NMP 46494; complete skull and hyoid bones; complete skin, hooves absent. A circular hole on the posterior edge of nasal bone (S), mandibular condylar and coronoid processes broken (S). Number of supra-orbital foramina: 1(S)/3(D). Canines: small. For skull measurements see Volf (2010a). **O**: *Equus hemionus kulan* ♂, 15 March 1979, a.n. 24/79; Prague Zoo, an offspring of parents caught in the Badhyz Reserve (Turkmenistan), SNr 330, SNa Praha 16, * 29 January 1975, age 4 years 2 months. **N**: *E. hemionus kulan*. The skin originally numbered as NMP 37455.

NMP 46495; complete skull. Number of supra-orbital foramina: one foramen on both sides. Canines: large. For skull measurements see Volf (2010a). **O**: *Equus hemionus kulan* ♂, 5 September 1988, a.n. 24/79; Liberec Zoo, SNr 828, SNa Liberec 9, * 21 September 1984, age 4 years. **N**: *E. hemionus kulan*.

Fig. 4. NMP collection includes many wild equids kept in captivity; however, many of them were born in the wild or represent the first generation in captivity; here *Equus hemionus kulan*, holotype (NMP 10698).
Obr. 4. Sbírka Národního musea uchovává množství koňovitých pocházejících ze zajetí, řada takových jedinců však byla narozena v přírodě či představuje první generaci odchovanou v zajetí; zde příklad holotypového jedince kulana (*Equus hemionus kulan*; NMP 10698).

NMP 46606; complete skull. Wolf tooth: present (both sides); number of supra-orbital foramina: two foramina on both sides. Canines: absent. For skull measurements see Volf (2010a). **O**: *Equus hemionus kulan* ♀, 27 May 1970, a.n. 64/70; Prague Zoo, SNr 25, SNa Praha 1, * 8 May 1959, age 11 years 1 month. **N**: *E. hemionus kulan*.

NMP 47172; complete skull. Diastema formation: 1 (Bendrey 2007a); number of supra-orbital foramina: 1(S)/3(D). Canines: very small – absent. For skull measurements see Volf (2010a). **O**: *Equus hemionus kulan* ♀, 14 March 1966, leg. J. Volf, a.n. 53/93; caught in the Badhyz Reserve (Turkmenistan); Prague Zoo, SNr 9, * ca. 1949, age 16 years. **N**: *E. hemionus kulan*.

Equus hartmannae Matschie, 1898

NMP 46339; complete juvenile skull (second molars finishing the eruption), second and third upper incisors (D) absent. CL=494, GB=195, ML=409. **O**: *Equus zebra hartmannae* ♀, 5 May 1989, a.n. 21/89, Prague Zoo. **N**: *E. hartmannae*. Age estimation: 2.5 years (Červený et al. 1999), 2.5 years (Joubert 1972). A gap of several millimetres long is present between second and third lower premolars, additionally, one deep hole (labially) between these premolars (S), pathological bone structure on the labial side of the mandible (S) below the diastema and premolars – cf. actinomycosis.

NMP 47536; complete skull, anterior part of second lower premolars high. Diastema formation: 0–1 (Bendrey 2007a); number of supra-orbital foramina: 2(S)/2–3(D). Canines: large. CL=512, GB=208, ML=429. **O**: *Equus zebra hartmannae* ♂, 28 October 1992, a.n. 7/96; Prague Zoo (from Dvůr Králové Zoo), caught in Namibia?, * in 1972?. **N**: *E. hartmannae*. Age estimation: 12 years (Červený et al. 1999), 9–11 years (Joubert 1972).

NMP 47634; complete juvenile skull (all premolars erupted, first and second molars in evidence). CL=387, GB=159, ML=315. **O**: *Equus zebra hartmannae* ♂, 23 July 1980, a.n. 66/91; Dvůr Králové Zoo, DK 388, * Dvůr Králové Zoo, age 4 months. **N**: *E. hartmannae*.

NMP 47635; complete juvenile skull (all premolars erupted, first molars in evidence). CL=270, GB=115, ML=221. **O**: *Equus zebra hartmannae* ♀, 19 May 1980, a.n. 66/91; Dvůr Králové Zoo, DK 472, * Dvůr Králové Zoo. **N**: *E. hartmannae*. Age estimation: 3–4 months (Červený et al. 1999), 1–3 months (Joubert 1972).

NMP 56799; complete skin, orange colouration (due to wrong preparation?). **O**: *Equus zebra hartmannae*, 1984, a.n. 56/91; Dvůr Králové Zoo, DK 264. **N**: *E. hartmannae*.

NMP 56965; complete skin. **O**: *Equus zebra hartmannae*, a.n. 56/91; Dvůr Králové Zoo, DK 278, juvenile. **N**: *E. hartmannae*.

NMP 57168; complete skin. **O**: *Equus zebra hartmannae*, 2002, a.n. 71/2003, Namibia; Ministry of Environment of the CR. **N**: *E. hartmannae*.

NMP 57169; complete skin. **O**: *Equus zebra hartmannae*, 2002, a.n. 71/2003, Namibia; Ministry of Environment of the CR. **N**: *E. hartmannae*.

NMP 93402; complete skull. Diastema formation: 0–1 (Bendrey 2007a); number of supra-orbital foramina: two foramina on both sides. Canines: very small – absent. CL=494, GB=200, ML=415. **O**: *Equus zebra hartmannae* ♀, 20 January 1980, a.n. 66/91; Dvůr Králové Zoo, DK 311, wild caught on 27 June 1972, age – adult. **N**: *E. hartmannae*. Age estimation: 7 years (Červený et al. 1999), 5–6 years (Joubert 1972). Irregular perforation and associated cracks in front of the orbit (D), posterior edge of the orbit (S) cracked. Coronoid process (D) damaged (abrasion).

NMP 93415; complete juvenile skull (second molars erupting). CL=493, GB=193, ML=410. **O**: *Equus zebra hartmannae* ♂, 2 May 1983, a.n. 66/91; Dvůr Králové Zoo, DK 601, * Dvůr Králové Zoo, age 2 years. **N**: *E. hartmannae*.

NMP 93419; complete juvenile skull (second molars nearly fully erupted), dorsal part of the braincase cut away (but preserved), fourth lower premolar (S) shift labially. CL=498, GB=197, ML=420. **O**: *Equus zebra hartmannae* ♀, 4 August 1987, a.n. 66/91; Dvůr Králové Zoo, DK 886, * Dvůr Králové Zoo, age 2 years, 2 months. **N**: *E. hartmannae*.

NMP 93357; complete juvenile skull (first molars in evidence/starting the eruption), one small circle hole in frontal region (D). CL=417, GB=171, ML=342. **O**: *Equus zebra hartmannae* ♂, 25 September 1977, a.n. 66/91; Dvůr Králové Zoo, DK 141, * Dvůr Králové Zoo, age 7 months, 15 days. **N**: *E. hartmannae*.

NMP 94144; sacrum and pelvis, limb skeleton; ossification of ligmants between the metapodials: 2. **O**: *Equus zebra hartmannae* ♀, 27 April 1984, Dvůr Králové Zoo, DK 656, adult. **N**: *E. hartmannae*.

NMP 94298; complete skull and pelvis; advanced tooth wear, third molars with an atypical wear (upper molars with reduced posterior parts, lower with increased posterior parts). Number of supra-orbital foramina: one foramen on both sides. Canines: large. CL=529, GB=217, ML=441. **O**: *Equus zebra hartmannae* ♂, 21 October 1986; Dvůr Králové Zoo, DK 811. **N**: *E. hartmannae*. Age estimation: 12 years (Červený et al. 1999), 9–11 years (Joubert 1972).

NMP 94318; sacrum and pelvis. **O**: *Equus zebra hartmannae* ♀, 29 May 1980; Dvůr Králové Zoo, DK 372, adult. **N**: *E. hartmannae*.

NMP 95117; complete skull. Number of supra-orbital foramina: 1(S)/2(D). Canines: absent. CL=493, GB=202, ML=413. **O**: *Equus zebra hartmannae* ♀, 29 June 1978; Dvůr Králové Zoo, DK 179, age 3 years. **N**: *E. hartmannae*.

NMP 95118; complete skull. Wolf tooth: on both sides (very small); number of supra-orbital foramina: several foramina on both sides. Canines: very small. CL=485, GB=198, ML=418. **O**: *Equus zebra hartmannae*, 10 January 1979; Dvůr Králové zoo, DK 230. **N**: *E. hartmannae*. Age estimation: 8 years (Červený et al. 1999), 4 years (Joubert 1972).

NMP 95119; complete juvenile skull (first molars starting the eruption). CL=377, GB=157, ML=315. **O**: *Equus zebra hartmannae* ♀, 3 January 1979; Dvůr Králové Zoo, DK 232, age 4 months. **N**: *E. hartmannae*.

NMP 95120; complete juvenile skull (first molars fully erupted). CL=464, GB=190, ML=384. **O**: *Equus zebra hartmannae* ♂, 29 April 1980; Dvůr Králové Zoo, DK 350, age 1 year 2 months. **N**: *E. hartmannae*.

NMP 95121; complete skull. Diastema formation: 1 (Bendrey 2007a); number of supra-orbital foramina: 1(S)/2(D). Canines: absent. CL=501, GB=206, ML=422. **O**: *Equus zebra hartmannae* ♀, 29 May 1980; Dvůr Králové Zoo, DK 372, adult. **N**: *E. hartmannae*. Age estimation: 10 years (Červený et al. 1999), 7–9 years (Joubert 1972).

NMP 95122; complete skull, relatively advanced tooth wear, lower cheektooth rows not compact, angulus mandibulae (S) deformed, less robust in effect. Number of supra-orbital foramina: 1(S)/?). Canines: very small – absent. CL=510, GB=200, ML=429. **O**: *Equus zebra hartmannae* ♂, adult, 4 March 1982; Dvůr Králové Zoo, DK 541. **N**: *E. hartmannae*. Age estimation: 8 years (Červený et al. 1999), 5–6 years (Joubert 1972).

NMP 95123; complete skull. Diastema formation: 1 (Bendrey 2007a); number of supra-orbital foramina: 1–3 (on both sides, 3 if minute foramina were counted). Canines: very small. CL=484, GB=200, ML=407. **O**: *Equus zebra hartmannae* ♀, 16 June 1983; Dvůr Králové Zoo, DK 612. **N**: *E. hartmannae*. Age estimation: 9 years (Červený et al. 1999), 7–9 years (Joubert 1972).

NMP 95124; complete skull, third lower incisor (S) broken. Number of supra-orbital foramina: several foramina on both sides. Canines: very small – absent. CL=508, GB=202, ML=424. **O**: *Equus zebra hartmannae* ♀, 1 January 1985; Dvůr Králové Zoo, DK 691, age 10 years 8 months. **N**: *E. hartmannae*.

NMP 95125; complete juvenile skull (first molars starting the eruption). CL~422, GB=171, ML=348. **O**: *Equus zebra hartmannae* ♀, 5 February 1987; Dvůr Králové Zoo, DK 840, age 7 months 15 days. **N**: *E. hartmannae*.

NMP 95126; complete juvenile skull (first molars starting the eruption), apices of nasal bones broken. CL=407, GB=171, ML=338. **O**: *Equus zebra hartmannae* ♀, 26 March 1987; Dvůr Králové Zoo, DK 845, age 8 months. **N**: *E. hartmannae*.

NMP 95127; complete skull. Diastema formation: 0–1 (Bendrey 2007a); number of supra-orbital foramina: two foramina on both sides. Canines: very small – absent. Infundibulum of the lower incisors: present. CL=521, GB=210, ML=442. **O**: *Equus zebra hartmannae* ♀, 19 March 1988; Dvůr Králové Zoo, DK 943, wild-caught on 1 September 1974), age 15 years. **N**: *E. hartmannae*.

NMP 95128; complete skull, dorsal part of the braincase cut away (preserved), relatively wide crack below crista facialis (D). Number of supra-orbital foramina: 2(S)/3(D). Canines: very small – absent. CL=519, GB=211, ML=438. **O**: *Equus zebra hartmannae* ♀, 3 September 1989; Dvůr Králové Zoo, DK 1/86, age 5 years 1 month. **N**: *E. hartmannae*. Second upper incisor (D) very small, third upper incisor (S) without an infundibulum in contrast to all other incisors.

NMP 95129; postcranial skeleton. **O**: *Equus zebra hartmannae* ♂, 21 June 1990; Dvůr Králové Zoo, DK 1/187, age 6 years 11 months. **N**: *E. hartmannae*.

NMP 95130; complete juvenile skull (first molars finishing the eruption), first (S) and third (D) upper and first lower (S) incisors broken. CL=422, GB=176, ML=346. **O**: *Equus zebra hartmannae* ♂, 6 May 1990; Dvůr Králové Zoo, DK 1/195, age 11 months. **N**: *E. hartmannae*.

DKZ 113466; complete skull, advanced and atypical tooth wear (e.g. anterior edge of upper molars high), cheektooth rows not compact (zigzag labial/lingual shifts of teeth), second lower molar (S) absent, third lower molar (D) with high posterior part. Number of supra-orbital foramina: 1(S)/2(D). Canines: absent. CL=528, GB=201, ML=450. **O**: *Equus zebra hartmannae* ♀, Háta, * 11 December 1983 (Dvůr Králové Zoo), † 21 January 2011 (Dvůr Králové Zoo). **N**: *E. hartmannae*.

DKZ [without number]; complete skull. Diastema formation: 2 (Bendrey 2007a); number of supra-orbital foramina: 1(S)/2(D). Canines: medium-sized. CL=526, GB=219, ML=442. **O**: *Equus zebra hartmannae* ♂, Paco, * 15 January 2001 (Sigean Zoo), † 3 July 2007 (Dvůr Králové Zoo). **N**: *E. hartmannae*.

Equus grevyi Oustalet, 1882

NMP 21895; complete skull (third molars finishing the eruption). Number of supra-orbital foramina: several foramina on both sides. Canines: absent. CL=555, GB=202, ML=454. **O**: *Equus grevyi* ♀, 12 May 1972, a.n. 19/73; wild-caught in Isiolo, Kenya, † Dvůr Králové Zoo. **N**: *E. grevyi*. Age estimation: 3 years (Červený et al. 1999), 3.5 years (Klingel & Klingel 1966), 3.5 years (Smuts 1974), 3.5 years (Joubert 1972).

NMP 46430; complete skull and hyoid bones; complete skin, hooves absent. Advanced tooth wear (plus cheektooth rows vary in height), first lower incisor (S) isolated. Number of supra-orbital foramina: one foramen on both sides. Canines: large. CL=580, GB=213, ML=476. **O**: *Equus grevyi* ♂, 11 June 1990, a.n. 38/90; Prague Zoo, wild-caught. **N**: *E. grevyi*. Age estimation: 16 years (Červený et al. 1999), 15–18 years (Klingel & Klingel 1966), 14 years (Smuts 1974), 11–13 years (Joubert 1972). Lower ramus of the mandible (S) with several irregular protuberances. The skin originally numbered as NMP 56888.

NMP 46431; complete skull and hyoid bones, advanced tooth wear, second lower incisor (D) isolated. Diastema formation: 1 (Bendrey 2007a); number of supra-orbital foramina: one foramen on both sides. Canines: absent. CL=573, GB=233, ML=464. **O**: *Equus grevyi* ♀, 17 June 1990, a.n. 39/90; Prague Zoo, age: adult. **N**: *E. grevyi*. Age estimation: 20 years (Červený et al. 1999), 17–20 years (Klingel & Klingel

1966), 17 years (Smuts 1974), 15 years plus (Joubert 1972). Three sharp protuberances present on the labial side of the left angular mandibular process (they are directed upwards). Several round protuberances on the right side of the interorbital region.

NMP 47270; complete juvenile skull (all premolars erupted, first molars in evidence), sacrum and pelvis. CL=399, GB=159, ML=324. **O**: *Equus grevyi* ♀, 29 May 1977, a.n. 66/91; Dvůr Králové Zoo, DK 96, * Dvůr Králové Zoo, age 3 months. **N**: *E. grevyi*.

NMP 47340; complete skull, very advanced tooth wear, first lower molars absent. Wolf tooth: present (D); number of supra-orbital foramina: one foramen on both sides. Canines: absent. CL=574, GB=215, ML=478. **O**: *Equus grevyi*, 17 November 1991, a.n. 18/95, wild-caught in Isiolo, Kenya, † Dvůr Králové Zoo. **N**: *E. grevyi*. Age estimation: 16 years (Červený et al. 1999), 15–18 years (Klingel & Klingel 1966), 14 years (Smuts 1974), 11–13 years (Joubert 1972).

NMP 47356; complete juvenile skull (only premolars erupted). CL=332, GB=130, ML=275. **O**: *Equus grevyi* ♂, 26 June 1987, a.n. 66/91; Dvůr Králové Zoo, DK 869, * Dvůr Králové Zoo, age 5 days. **N**: *E. grevyi*.

NMP 47357; complete juvenile skull (only premolars erupted). CL=317, GB=127, ML=266. **O**: *Equus grevyi* ♀, 19 December 1987, a.n. 66/91; Dvůr Králové Zoo, DK 925, * Dvůr Králové Zoo, age 1 day. **N**: *E. grevyi*.

NMP 47519; complete juvenile skull (only premolars erupted), dorsal part of the braincase broken (preserved). CL=321, GB=125, ML=267. **O**: *Equus grevyi* ♂, 13 August 1981, a.n. 66/91; Dvůr Králové Zoo, DK 494, * Dvůr Králové Zoo, age 5 days. **N**: *E. grevyi*.

NMP 47606; complete juvenile skull (all premolars erupted, first molars in evidence). CL=316, GB=133, ML=260. **O**: *Equus grevyi* ♀, 13 August 1981, a.n. 66/91; Dvůr Králové Zoo, DK 228, * Dvůr Králové Zoo, age 1 year, 6 months. **N**: *E. grevyi*.

NMP 47607; complete juvenile skull (all premolars erupted, first molars in evidence). CL=384, GB=136, ML=282. **O**: *Equus grevyi* ♂, 2 September 1989, a.n. 66/91; Dvůr Králové Zoo, DK 1/93, * Dvůr Králové Zoo. **N**: *E. grevyi*. Age estimation: 4 weeks (Červený et al. 1999), one to few weeks (Klingel & Klingel 1966), 2 weeks – 3 months (Smuts 1974), 1–3 weeks (Joubert 1972).

NMP 47631; complete juvenile skull (all premolars erupted, first molars in evidence). CL=342, GB=132, ML=280. **O**: *Equus grevyi* ♂, a.n. 66/91; Dvůr Králové Zoo, DK 558. **N**: *E. grevyi*. Age estimation: 4 weeks (Červený et al. 1999), one to few weeks (Klingel & Klingel 1966), 2 weeks – 3 months (Smuts 1974), 1–3 weeks (Joubert 1972).

NMP 48534; complete skull. Canines: absent. CL=553, GB=205, ML=468. **O**: *Equus grevyi* ♀, 18 May 2000, a.n. 83/2000; Dvůr Králové Zoo. **N**: *E. grevyi*. Age estimation: 10 years (Červený et al. 1999), 5–6 years (Klingel & Klingel 1966), 10 years (Smuts 1974), 7–9 years (Joubert 1972).

NMP 56960; Complete skin, hooves absent. **O**: *Equus grevyi*, a.n. 56/91; Dvůr Králové Zoo, DK 21. **N**: *E. grevyi*.

NMP 56879; complete skin, hooves absent. **O**: *Equus grevyi*, a.n. 56/91; Dvůr Králové Zoo, DK 486, juvenile. **N**: *E. grevyi*.

NMP 56955; complete skin, several naked places present. **O**: *Equus grevyi*, a.n. 56/91; Dvůr Králové Zoo, DK 67. **N**: *E. grevyi*.

NMP 56873; complete skin, orange colouration (due to wrong preparation?). **O**: *Equus grevyi*, a.n. 56/91; Dvůr Králové Zoo, DK 209, juvenile. **N**: *E. grevyi*.

NMP 56886; complete skin, hooves absent. **O**: *Equus burchelli boehmi* ♀, a.n. 56/91; Dvůr Králové Zoo, DK 494. **N**: *E. grevyi*.

NMP 93410; complete skull (third molars finishing the eruption). Number of supra-orbital foramina: one foramen on both sides. Canines: absent. CL=517, GB=196, ML=428. **O**: *Equus grevyi* ♀, 31 October 1987, a.n. 66/91; Dvůr Králové Zoo, DK 904, * Dvůr Králové Zoo, age 3 years 3 months. **N**: *E. grevyi*. The "sagital crest" extends laterally (D) of the braincase.

NMP 93422; complete juvenile skull (first molars erupted, second molars in evidence). CL=565, GB=208, ML=428. **O**: *Equus burchelli chapmani* ♀, 18 April 1990, a.n. 66/91; Dvůr Králové Zoo, DK 1/147, * Dvůr Králové Zoo, age 1 year. **N**: *E. grevyi*.

NMP 93434; complete juvenile skull (first molars finishing eruption, second molars in evidence), apex of both nasal bones broken, the left one preserved. CL=512, GB=188, ML=411. **O**: *Equus grevyi* ♂, 19 October 1986, a.n. 66/91; Dvůr Králové Zoo, DK 826, * Dvůr Králové Zoo, age 1 year, 3 months, 15 days. **N**: *E. grevyi*

NMP 94113; complete skull. Diastema formation: 0–1 (Bendrey 2007a); number of supra-orbital foramina: 3(S)/1(D). Canines: very small – absent. CL=577, GB=218, ML=480. **O**: *Equus grevyi* ♀, 10 March 1983; Dvůr Králové Zoo, DK 596, wild-caught 2 July 1974, Kenya, adult. **N**: *E. grevyi*. Age estimation: 12 years (Červený et al. 1999), 9–11 year (Klingel & Klingel 1966), 10 years (Smuts 1974), 9–11 years (Joubert 1972).

NMP 94301; autopodium (skeleton) of the forelimb (S), sacrum and pelvis. **O**: *Equus grevyi* ♀, 27 April 1982; Dvůr Králové Zoo, DK 45, age 5 years. **N**: *E. grevyi*.

NMP 94297; complete skull, pelvis. Number of supra-orbital foramina: one foramen (S)/two foramina (D). Canines: large. CL=592 mm, GB=228 mm, ML=486 mm. **O**: *Equus grevyi* ♂, 24 July 1986, Dvůr Králové Zoo, DK 798, adult. **N**: *E. grevyi*. Age estimation: 10 years (Červený et al. 1999), 9–11 years (Klingel & Klingel 1966), 10 years (Smuts 1974), 9–11 years (Joubert 1972).

NMP 94956; complete skull and skeleton; complete skin. **O**: *E. grevyi* ♀, a.n. 71/2014; Ostrava Zoo, HNa Bára, * 18 July 2000, † 28 March 2014. **N**: *E. grevyi*.

NMP 95131; complete skull, second upper incisor (S) absent, small circulal protuberance on the ventral side of the mandible (S), one healed ?abscess on the ventral side of the mandible (D), lower canine (D) absent. Number of supra-orbital foramina: two foramina on both sides. Canines: large. CL=575, GB=224, ML=463. **O**: *Equus grevyi* ♂, 3 October 1974; Dvůr Králové Zoo, DK 45, age 5 years. **N**: *E. grevyi*.

NMP 95132; complete skull. Diastema formation: 1–2 (Bendrey 2007a); number of supra-orbital foramina: one on both sides. Canines: absent. CL=560, GB=203, ML=458. **O**: *Equus grevyi*, Dvůr Králové Zoo, DK 54. **N**: *E. grevyi*. Age estimation: 10 years (Červený et al. 1999), 5–6 years (Klingel & Klingel 1966), 6–7 years (Smuts 1974), 7–9 years (Joubert 1972).

NMP 95133; complete skull, one small round hole in the interorbital and one in parietal region, third upper incisor (D) broken. Number of supra-orbital foramina: one foramen on both sides. Canines: absent. CL=565, GB=208, ML=463. **O**: *Equus grevyi*, Dvůr Králové Zoo, DK ?147. **N**: *E. grevyi*. Age estimation: 8 years (Červený et al. 1999), 5–6 years (Klingel & Klingel 1966), 8–9 years (Smuts 1974), 7–9 years (Joubert 1972).

NMP 95134; complete juvenile skull (second molars erupting). CL=515, GB=200, ML=426. **O**: *Equus grevyi* ♂, 23 March 1979; Dvůr Králové Zoo, DK 240, age 2 years. **N**: *E. grevyi*.

NMP 95135; complete juvenile skull (second molars erupted, third molars only partly in evidence, not erupted). CL=559, GB=534, ML=458. **O**: *Equus grevyi* ♀, 20 July 1979; Dvůr Králové Zoo, DK 262, age 2 years 6 months. **N**: *E. grevyi*.

NMP 95136; complete juvenile skull (first molars starting the eruption), upper posterior part of the orbit (D) broken. CL=455, GB=172, ML=377. **O**: *Equus grevyi* ♂, 7 August 1980; Dvůr Králové Zoo, DK 397, age 6 months 15 days. **N**: *E. grevyi*.

NMP 95137; complete skull. Diastema formation: 0–1 (Bendrey 2007a); number of supra-orbital foramina: ? Canines: very small – absent. Infundibulum of the lower incisors: present. CL=561, GB=202, ML=460. **O**: *Equus grevyi* ♀, 26 September 1986; Dvůr Králové Zoo, DK 812, age 6 years 1 month 15 days. **N**: *E. grevyi*.

NMP 95138; complete juvenile skull (second molars starting the eruption), upper rostrum (D) broken, 6 incisors isolated. CL=520, GB=196, ML=424. **O**: *Equus grevyi* ♀, 12 February 1987; Dvůr Králové Zoo, DK 843, age 1 year 8 months. **N**: *E. grevyi*. Lower edge of the angular mandibular process possesses medium-sized ellipsoid protuberance.

NMP 95139; complete juvenile skull (second molars erupting), a rectangle from the dorsal part of the braincase cut away (preserved), three isolated incisors. CL=547, GB=203, ML=451. **O**: *Equus grevyi* ♂, 23 March 1987; Dvůr Králové Zoo, DK 853, age 2 years 1 month 15 days. **N**: *E. grevyi*.

NMP 95140; complete juvenile skull (third molars starting the eruption). CL=553, GB=212, ML=453. **O**: *Equus grevyi* ♂, 17 March 1987, Dvůr Králové Zoo, DK 860, age 3 years. **N**: *E. grevyi*. The first lower incisor (S) sideward (looking from the front).

NMP 95141; complete skull. Number of supra-orbital foramina: one foramen on both sides. Canines: very small – absent. CL=535, GB=205, ML=444. **O**: *Equus grevyi* ♀, 7 September 1987; Dvůr Králové Zoo, DK 876, 8 years. **N**: *E. grevyi*.

NMP 95142; complete skull. Number of supra-orbital foramina: 1(S)/2(D). Canines: small. CL=545, GB=210, ML=452. **O**: *Equus grevyi* ♀, 3 September 1989; Dvůr Králové Zoo, DK 1/100, age 9 years 11 months. **N**: *E. grevyi*.

NMP 95143; complete skull, one hole on the frontal bone and posterior edge of the nasal bone (S). Diastema formation: 0 (Bendrey 2007a); wolf tooth: present (S); number of supra-orbital foramina: 2(S)/1(D). Canines: large. CL=596, GB=206, ML=488. **O**: *Equus grevyi*, Dvůr Králové Zoo, DK 55. **N**: *E. grevyi*. Age estimation: 6 years (Červený et al. 1999), 4–6 years (Klingel & Klingel 1966), 5 years (Smuts 1974), 4–6 years (Joubert 1972).

NMP 95144; complete skull, advanced tooth wear, region in front of foramen infraorbitale (D) porous (with many tiny holes), third upper incisor (D) absent. Wolf tooth: both sides; number of supra-orbital foramina: one on both sides. Canines: absent. CL=583, GB=220, ML=485. **O**: *Equus grevyi* ♀, 25 August 1977; Dvůr Králové Zoo, DK 142. **N**: *E. grevyi*. Age estimation: 10? years (Červený et al. 1999), 5–6 years (Klingel & Klingel 1966), 8–9 years (Smuts 1974), 9–11 years (Joubert 1972).

NMP 95145; complete skull; a small hole in the frontal region and a somewhat healed deep circular hole is present on the lower side of mandible (S). Number of supra-orbital foramina: 2(S)/1(D). Canines: absent. CL=551, GB=194, ML=464. **O**: *Equus grevyi* ♀, 7 April 1981; Dvůr Králové Zoo, DK 463, adult. **N**: *E. grevyi*. Age estimation: 10 years (Červený et al. 1999), 7–9 years (Klingel & Klingel 1966), 10 years (Smuts 1974), 9–11 years (Joubert 1972).

NMP 95146; complete skull. Number of supra-orbital foramina: one foramen (S)/two foramina (D). Canines: very small. CL=560, GB=202, ML=459. **O**: *Equus grevyi* ♀, 27 April 1982; Dvůr Králové Zoo, DK 556. **N**: *E. grevyi*. Age estimation: 10 years (Červený et al. 1999), 9–11 years (Klingel & Klingel 1966), 10 years (Smuts 1974), 9–11 years (Joubert 1972).

NMP 95147; complete skull, ramus mandibulae abraded (with an irregular hole below coronid and condylar processes). Number of supra-orbital foramina: on foramen on both sides. Canines: very small – absent.

Fig. 4. Old individuals of wild equids kept in captivity often exhibit abnormal tooth wear and incompact cheektooth rows; here demonstrated in *Equus grevyi* (DKZ 106665).
Obr. 4. Staří jedinci divokých koňovitých chovaní v zajetí často vykazují neobvykle silný obrus a nestejnoměrný růst zubů; zde příklad zebry Grévyho (*Equus grevyi*; sbírka zoologické zahrady ve Dvoře Králové, č. 106665).

CL=552, GB=216, ML=453. **O**: *Equus grevyi* ♀, 15 January 1984; Dvůr Králové Zoo, DK 637, adult. **N**: *E. grevyi*. Age estimation: 12–16 years (Červený et al. 1999), 12–14 years (Klingel & Klingel 1966), 12 years (Smuts 1974), 11–13 years (Joubert 1972).

NMP 95148; complete skull, two small holes in the parietal region. Number of supra-orbital foramina: 2(S)/1(D). Canines: absent. CL=564, GB=210, ML=460. **O**: *Equus grevyi* ♀, 15 January 1984; Dvůr Králové Zoo, DK 642, adult **N**: *E. grevyi*. Age estimation: 10–12 years (Červený et al. 1999), 9–11 years (Klingel & Klingel 1966), 12 years (Smuts 1974), 9–11 years (Joubert 1972).

NMP 95149; complete skull. Diastema formation: 1 (Bendrey 2007a); number of supra-orbital foramina: 2(S)/1(D). Canines: large. CL=573, GB=212, ML=474. **O**: *Equus grevyi* ♂, 8 June 1984; Dvůr Králové Zoo, DK 675, adult. **N**: *E. grevyi*. Age estimation: 20 years (Červený et al. 1999), 17–20 years (Klingel & Klingel 1966), 17 years (Smuts 1974), 15 years plus (Joubert 1972).

NMP 95150; complete skull, advanced tooth wear. Diastema formation: 0–1 (Bendrey 2007a); number of supra-orbital foramina: one foramen on both sides. Canines: absent. CL=547, GB=207, ML=452. **O**: *Equus grevyi* ♀, 8 June 1985; Dvůr Králové Zoo, DK 715, adult. **N**: *E. grevyi*. Age estimation: 12 years (Červený et al. 1999), 9–11 years (Klingel & Klingel 1966), 13 years (Smuts 1974), 9–11 years (Joubert 1972).

NMP 95151; complete skull, very advanced tooth wear (third lower molars much higher than the remaining teeth in the row), apex of the nasal bone (D) broken. Diastema formation: 1 (Bendrey 2007a); number of supra-orbital foramina: 1(S)/3(D). Canines: absent. CL=564, GB=213, ML=462. **O**: *Equus grevyi* ♀, 2 July 1988; Dvůr Králové Zoo, DK 965, wild-caught on 20 September 1975, Kenya. **N**: *E. grevyi*. Age

estimation: 16 years (Červený et al. 1999), 15–18 year (Klingel & Klingel 1966), 14 years (Smuts 1974), 11–13 years (Joubert 1972).

NMP 95152; complete skin, hooves absent, several naked areas (on the back). **O**: Ethiopia, leg. K. Bambas, 1937. **N**: *E. grevyi*.

DKZ 106665; complete skull, very advanced tooth wear, first and second upper molars (D) extremely long, suppressing the counterpart teeth (absent) in mandible, left maxillary cheektooth row only with second premolar and third molar (remaining teeth absent), mandible cheekteeth zigzag shifted (cheektooth rows are thus not compact) (Fig. 4). Diastema formation: 1 (Bendrey 2007a); number of supra-orbital foramina: several small foramina on both sides. Canines: very small – absent. CL=513, GB=205, ML=432. **O**: *Equus grevyi* ♀, before 1977. **N**: *E. grevyi*. Age estimation: 12–16 years (Červený et al. 1999), 9–11 years (Klingel & Klingel 1966), 12 years (Smuts 1974), 9–11 years (Joubert 1972).

DKZ [without number]: complete skull, advanced tooth wear, first upper incisor suppressed by the second, cheektooth rows not so compact, the second lower premolar (D) abnormally high. Diastema formation: 2 (Bendrey 2007a); number of supra-orbital foramina: 1(S)/2(D). Canines: absent. CL=574, GB=215, ML=475. **O**: *Equus grevyi* ♀, Gena, * 11 July 1987 (Dvůr Králové Zoo), † 27 September 2008 (Dvůr Králové Zoo). **N**: *E. grevyi*.

DKZ [without number]; hoof and phalanx III + complete skull, advanced tooth wear, first lower incisor (S) very small, all lower premolars much higher than molars. Diastema formation: 0–1 (Bendrey 2007a); number of supra-orbital foramina: 2(S)/1(D). Canines: large. CL=598, GB=221, ML=480. **O**: *Equus grevyi* ♂, Shektar/Watt, * 22 September 1987 (Prague Zoo), † 8 October 2007 (Dvůr Králové Zoo). **N**: *E. grevyi*.

Equus quagga burchellii (Gray, 1824)

NMP 12775; damaged skin, tail and hooves absent. **O**: *Equus burchellii* ♂, a.n. 46/73; Liberec Zoo. **N**: *E. quagga burchellii* (Damara zebra).

NMP 12783; complete skin. **O**: *Equus burchellii* ♂, 10 December 1945, a.n. 6358/45; Prague Zoo. **N**: *E. quagga burchellii* (Damara zebra).

NMP 47148; complete skull and hyoid bones. Number of supra-orbital foramina: two foramina on both sides. Canines: large. Infundibulum of the lower incisors: absent. CL=491, GB=190, ML=404. **O**: *Equus burchelli antiquorum* ♂, 14 November 1993, a.n. 53/93; Dvůr Králové Zoo, caught in Namibia, transported on 28 October 1984. **N**: *E. quagga burchellii* (Damara zebra). Age estimation: 12 years (Červený et al. 1999), 7–11 years (Klingel & Klingel 1966), 11 years (Smuts 1974).

NMP 47362; complete juvenile skull (all premolars erupted, first molars in evidence). CL=272, GB=111, ML=222. **O**: *Equus burchelli antiquorum* ♂, 13 October 1977, a.n. 66/91; Dvůr Králové Zoo, DK 82, * Dvůr Králové Zoo (251/77), age 1 day. **N**: *E. quagga burchellii* (Damara zebra).

NMP 47632; complete juvenile skull (all premolars erupted, first molars in evidence). CL=273, GB=109, ML=228. **O**: *Equus burchelli antiquorum* ♀, 6 March 1980, a.n. 66/91; Dvůr Králové Zoo, DK 340, * Dvůr Králové Zoo, age 4 days. **N**: *E. quagga burchellii* (Damara zebra).

NMP 47679; complete skull and hyoid bones. Wolf tooth: present (S), number of supra-orbital foramina: 3(S)/1(D). Canines: small – absent. Infundibulum of the lower incisors: present. CL=500, GB=199, ML=401. **O**: *Equus burchelli antiquorum*, 4 May 1997, a.n. 23/97; Dvůr Králové Zoo. **N**: *E. quagga burchellii* (Damara zebra). Age estimation: 10–12 years (Červený et al. 1999), 7–9 years (Klingel & Klingel 1966), 11 years (Smuts 1974).

NMP 56796; complete skin. **O**: *Equus burchelli chapmanni*, 1985, a.n. 56/91; Dvůr Králové Zoo, DK 325. **N**: *E. quagga burchellii* (Damara zebra) – legs without stripes.

NMP 56897; complete skin. **O**: *Equus burchelli antiquorum*, a.n. 56/91; Dvůr Králové Zoo, DK 474, juvenile. **N**: *E. quagga burchellii* (Damara zebra).

NMP 56954; complete skin. **O**: *Equus burchellii antiquorum*, a.n. 56/91, Dvůr Králové Zoo, DK 448. **N**: *E. quagga burchellii* (Damara zebra).

NMP 93088; complete skull, pelvis and sacrum. Wolf tooth: present (D), number of supra-orbital foramina: one foramen on both sides. Canines: small. Infundibulum of the lower incisors: absent. CL=521, GB=204, ML=411. **O**: *Equus burchelli antiquorum* ♀, 19 February 1981, a.n. 66/91; Dvůr Králové Zoo, DK 452, wild-caught on 22 October 1971, adult. **N**: *E. quagga burchellii* (Damara zebra). Age estimation: 10–12 years (Červený et al. 1999), 7–9 years (Klingel & Klingel 1966), 11 years (Smuts 1974).

NMP 93398; complete juvenile skull (first molars erupting), occipital region broken, but preserved. CL~428, GB=169, ML=351. **O**: *Equus burchelli antiquorum* ♂, 11 May 1980, a.n. 66/91; Dvůr Králové Zoo (specimen was obtained from Prague Zoo), DK 360, age 2 years. **N**: *E. quagga burchellii* (Damara zebra).

NMP 93408; complete juvenile skull (first molars finishing the eruption process, second molars in evidence). CL=456, GB=184, ML=378. **O**: *Equus burchelli antiquorum* ♂, 20 April 1979, a.n. 66/91; Dvůr Králové Zoo, DK 267, age 1 year, 6 months. **N**: *E. quagga burchellii* (Damara zebra).

NMP 93425; complete skull. Diastema formation: 2 (Bendrey 2007a); number of supra-orbital foramina: one foramen on both sides. Canines: large. Infundibulum of the lower incisors: present. CL=497, GB=196, ML=403. **O**: *Equus burchelli antiquorum* ♂, 13 November 1980, a.n. 66/91; Dvůr Králové Zoo, DK 442, wild-caught on 27 June 1972. **N**: *E. quagga burchellii* (Damara zebra). Age estimation: 12 years (Červený et al. 1999), 9–11 years (Klingel & Klingel 1966), 12–13 years (Smuts 1974).

NMP 93430; complete skull and hyoid bones, sacrum and pelvis. Wolf tooth: on one side (S); number of supra-orbital foramina: one foramen on both sides. Canines: very small. Infundibulum of the lower incisors: absent. CL=487, GB=189, ML=405. **O**: *Equus burchelli antiquorum* ♀, 3 November 1986, a.n. 66/91; Dvůr Králové Zoo, DK 816, wild caught on 26 October 1984, Namibia (van den Brink), age – adult. **N**: *E. quagga burchellii* (Damara zebra). Age estimation: 7 years (Červený et al. 1999), 7–9 years (Klingel & Klingel 1966), 8–9 years (Smuts 1974).

NMP 94139; autopodium (skeleton) of the forelimb (S); sacrum + pelvis. **O**: *Equus burchelli antiquorum* ♀, 28 May 1980; Dvůr Králové Zoo, DK 368, adult. **N**: *E. quagga burchellii* (Damara zebra).

NMP 95153; complete skull, one small round hole in the interorbital region, one long crack is present from frontal to occipital region (D). Number of supra-orbital foramina: two foramina on both sides. Canines: very small – absent. Infundibulum of the lower incisors: absent. CL=490, GB=201, ML=405. **O**: *Equus burchelli antiquorum* ♀, 11 March 1979; Dvůr Králové Zoo, DK 202, age 4 years. **N**: *E. quagga burchellii* (Damara zebra).

NMP 95154; complete skull, first upper incisor (S) with a lower crown towards remaining incisors. Diastema formation: 1 (Bendrey 2007a); wolf tooth: on both sides; number of supra-orbital foramina: 1(S)/2(D). Canines: absent. CL=502, GB=205, ML=418. **O**: *Equus burchelli antiquorum* ♀, 30 April 1980; Dvůr Králové Zoo, DK 349, age 11 years. **N**: *E. quagga burchellii* (Damara zebra).

NMP 95155; complete skull, maxila (S) cracked, *os parietale* (S) cracked, posterior third of right orbit and the associate part of braincase broken. First and second upper incisors broken. Number of supra-orbital foramina: one foramen on both sides. Canines: absent. CL=521, GB×, ML=423. **O**: *Equus burchelli antiquorum* ♀, 22 February 1986; Dvůr Králové Zoo, DK 766, age 7 years 5 months. **N**: *E. quagga burchellii* (Damara zebra).

NMP 95156; complete juvenile skull (first molars starting the eruption). CL=406, GB=166, ML=337. **O**: *Equus burchelli antiquorum* ♂, 21 December 1987, Dvůr Králové Zoo, DK 936, age 8 months 15 days. **N**: *E. quagga burchellii* (Damara zebra).

NMP 95157; complete skull, two shallow holes in the angular mandibular region (S, labial side). Diastema formation: 0–1 (Bendrey 2007a); number of supra-orbital foramina: 1(S)/3(D). Canines: medium-sized – small. Infundibulum of the lower incisors: present. CL=489, GB=189, ML=405. **O**: *Equus burchelli antiquorum* ♀, 15 September 1989, Dvůr Králové Zoo, DK 1/116, age 9 years. **N**: *E. quagga burchellii* (Damara zebra).

NMP 95158; complete skull. Wolf tooth: on both sides; number of supra-orbital foramina: one foramen on both sides. Canines: very small – absent. CL=484, GB=188, ML=406. **O**: *Equus burchelli antiquorum* ♀, 28 May 1980; Dvůr Králové Zoo, DK 368, adult. **N**: *E. quagga burchellii* (Damara zebra). Age estimation: 10 years (Červený et al. 1999), 7–11 years (Klingel & Klingel 1966), 11 years (Smuts 1974), 9–11 years (Joubert 1972).

NMP 95159; complete skull, one small round hole in the frontal region, first upper (D) and lower (D) incisors absent. Number of supra-orbital foramina: one foramen on both sides. Canines: medium-sized – absent. Infundibulum of the lower incisors: detectable – absent. CL=521, GB=204, ML=440. **O**: *Equus burchelli antiquorum* ♀, 19 February 1981; Dvůr Králové Zoo, DK 452, adult. **N**: *E. quagga burchellii* (Damara zebra). Age estimation: 8 years (Červený et al. 1999), 7–9 years (Klingel & Klingel 1966), 6–7? years (Smuts 1974).

DKZ 105817; complete skin, hooves absent. **O**: n. 416. **N**: *E. quagga burchellii* (Damara zebra).

DKZ [without number]; complete skull, first and second lower molars shifted labially. Diastema formation: 0–1 (Bendrey 2007a); wolf tooth: absent, number of supra-orbital foramina: one foramen on both sides. Canines: large. Infundibulum of the lower incisors: present. CL=499, GB=203, ML=413. **O**: *Equus burchellii antiquorum* ♂, Niko, * 6 December 1991 (Krefeld Zoo), † 23 June 2004 (Dvůr Králové Zoo). **N**: *E. quagga burchellii* (Damara zebra).

Equus quagga chapmani Layard, 1865

NMP 9895; mounted skin. **O**: *Equus burchellii chapmanni* ♂, purchased from V. Frič [trade company] for 40 guldens (obtained in Africa), a.n. 3460/1893 (n. 2796), prepared by J. Štrof (NMP). **N**: *E. quagga chapmani*.

NMP 10798; complete skull. Diastema formation: 1-2 (Bendrey 2007a). Canines: large. CL=467, GB=189, ML=388. **O**: *Equus burchelli chapmanni* ♂, 3976. **N**: *E. quagga chapmani*. Age estimation: 12–16 years (Červený et al. 1999), 11–13 years (Klingel & Klingel 1966), 13–14 years (Smuts 1974).

NMP 21894; complete skull, pelvis and sacrum, first upper incisors isolated, angulus mandibulae (S) broken; complete skin. Diastema formation: 1 (Bendrey 2007a); number of supra-orbital foramina: 2(S)/3(D). Canines: absent. Infundibulum of the lower incisors: detectable. CL=488, GB=196, ML=405. **O**: *Equus burchelli* ♀, 19 April 1972, a.n. 20/73; Dvůr Králové Zoo, originated from Mozambique. **N**: *E. quagga chapmani*. Age estimation: 9–10 years (Červený et al. 1999), 9–11 years (Klingel & Klingel 1966), 11 years (Smuts 1974). The skin originally numbered as NMP 40420.

NMP 40941; complete skin, hooves absent. **O**: *Equus burchelli chapmanni*, 29 December 1960, a.n. 161/60; Prague Zoo, juvenile. **N**: *E. quagga chapmani*.

NMP 47501; complete juvenile skull (all premolars erupted, first molars in evidence). CL=337, GB=135, ML=278. **O**: *Equus burchelli chapmanni*, 30 August 1979, a.n. 66/91; Dvůr Králové Zoo, DK 270, * Dvůr Králové Zoo, age 1 month. **N**: *E. quagga chapmani*.

NMP 47608; complete juvenile skull (all premolars erupted, first molars in evidence). CL=297, GB=122, ML=246. **O**: *Equus burchelli chapmanni* ♀, 4 December 1981, a.n. 66/91; Dvůr Králové Zoo, DK 523, * Dvůr Králové Zoo, age 1 day. **N**: *E. guagga chapmani*.

NMP 47609; complete juvenile skull (all premolars erupted, first molars in evidence). CL=402, GB=166, ML=329. **O**: *Equus burchelli chapmanni* ♂, 8 May 1989, a.n. 66/91; Dvůr Králové Zoo, DK 1/50, * Dvůr Králové Zoo, age 7 months. **N**: *E. quagga chapmani*.

NMP 56795; complete skin, hooves absent. **O**: *Equus burchelli chapmanni*, 1990, a.n. 56/91; Dvůr Králové Zoo, DK 512. **N**: *E. quagga chapmani*.

NMP 56797; complete skull, complete skin, hooves absent. Number of supra-orbital foramina: one foramen on both sides. Canines: absent. CL=551, GB=208, ML=453. **O**: *Equus burchelli chapmanni*, 1991, a.n. 56/91; Dvůr Králové Zoo, DK 557. **N**: *E. quagga chapmani*. Age estimation: 9 years (Červený et al. 1999), 5–6 years (Klingel & Klingel 1966), 8–9 years (Smuts 1974).

NMP 56798; complete skin, several holes in the skin, orange colouration. **O**: *Equus burchelli chapmanni*, 1984, a.n. 56/91; Dvůr Králové Zoo, DK 219. **N**: *E. quagga chapmani*.

NMP 93359; complete skull, occipital crest (D) partly damaged (broken). Number of supra-orbital foramina: several foramina on both sides. Canines: absent. Infundibulum of the lower incisors: present. CL=480, GB=193, ML=398. **O**: *Equus burchelli chapmani* ♀, 4 December 1990, a.n. 66/91; Dvůr Králové Zoo, DK 765, purchased from van den Brink on 2 June 1970, age – adult. **N**: *E. quagga chapmani*. Age estimation: 16 years (Červený et al. 1999), 9–11 years (Klingel & Klingel 1966), 12 years (Smuts 1974).

NMP 93396; complete skull, pelvis and sacrum. Diastema formation: 1–2 (Bendrey 2007a); number of supra-orbital foramina: several foramina on both sides. Canines: absent. Infundibulum of the lower incisors: absent. CL=508, GB=192, ML=419. **O**: *Equus burchelli chapmani* ♀, 18 June 1982, a.n. 66/91; Dvůr Králové Zoo, DK 562, wild-caught on 2 June 1970, adult. **N**: *E. quagga chapmani*. Age estimation: 6–7 years (Červený et al. 1999), 4 years (Klingel & Klingel 1966), 6–7 years (Smuts 1974).

NMP 93429; complete juvenile skull (second upper molars erupting, first lower molars erupting), occipital crest (D) broken. CL=452, GB=186, ML=372. **O**: *Equus burchelli chapmani*, a.n. 66/91; Dvůr Králové Zoo, DK 22. **N**: *E. quagga chapmani*. Age estimation: 2–3 years (Červený et al. 1999), 1.5 years (Klingel & Klingel 1966), 6–9 months (Smuts 1974).

NMP 95160; complete juvenile skull (first molars starting the eruption). CL=439, GB=178, ML=368. **O**: *Equus burchelli chapmanni* ♀, 30 July 1981; Dvůr Králové Zoo, DK 498, age 8 months. **N**: *E. quagga chapmani*.

NMP 95161; complete juvenile skull (first molars erupting). CL=429, GB=167, ML=351. **O**: *Equus burchelli chapmanni* ♂, 19 January 1988; Dvůr Králové Zoo, DK 931, * Dvůr Králové Zoo, age 9 months. **N**: *E. quagga chapmani*.

NMP 95162; complete juvenile skull (third molars starting the eruption), first upper incisor (S) absent. CL=453, GB=181, ML=378. **O**: *Equus burchelli chapmanni*; Dvůr Králové Zoo, DK 20. **N**: *E. guagga chapmani*. Age estimation: 3.5–4.5 years (Červený et al. 1999), other age estimation protocols are hardly applicable due to an atypical disproportion between the incisor × cheekteeth eruption.

NMP 95163; complete skull, most incisors isolated. Diastema formation: 0–1 (Bendrey 2007a); number of supra-orbital foramina: 2(S)/?. Canines: large. CL=520, GB=199, ML~431. **O**: *Equus burchelli chapmanni* ♀, 25 December 1987; Dvůr Králové Zoo, DK 923, purchased from van den Brink on 30 July 1981, adult. **N**: *E. quagga chapmani*. Age estimation: 10? years (Červený et al. 1999), 5–6 years (Klingel & Klingel 1966), 8–9 years (Smuts 1974), 9–11 years (Joubert 1972).

DKZ 110386; complete skin, hooves absent. **O**: *Equus burcheli chapmani*. **N**: *E. quagga chapmani*.

DKZ [without number]; complete skull, advanced tooth wear. Number of supra-orbital foramina: several minute foramina on both sides. Canines: large. Infundibulum of the lower incisors: present. CL=495, GB=190, ML=427. **O**: *Equus burchellii chapmanni* ♂, Robin, * 26 April 1984 (Brno Zoo, CR), † 25 July 2005 (Dvůr Králové Zoo). **N**: *E. quagga chapmani*.

Equus quagga boehmi Matschie, 1892

NMP 47358; complete juvenile skull (all premolars erupted, first molars in evidence). CL=280, GB=115, ML=234. **O**: *Equus burchelli boehmi* ♂, 8 April 1987, a.n. 66/91; Dvůr Králové Zoo, DK 851, * Dvůr Králové Zoo, age 13 days. **N**: *E. quagga boehmi*.

NMP 47610; complete juvenile skull (all premolars erupted, first molars in evidence). CL=304, GB=124, ML=249. **O**: *Equus burchelli boehmi* ♂, 23 February 1990, a.n. 66/91; Dvůr Králové Zoo, DK 1/131, * Dvůr Králové Zoo (269/76), age 10 days. **N**: *E. quagga boehmi*.

NMP 51175; complete skin, hooves absent. **O**: *Equus burchelli boehmi* ♀, a.n. 56/91; Dvůr Králové Zoo, DK 535, juvenile. **N**: *E. quagga boehmi*.

NMP 56800; complete skin, orange colouration (due to an inappropriate preparation method?). **O**: *Equus burchelli boehmi* ♀, 1983, a.n. 56/91; Dvůr Králové Zoo, DK 230. **N**: *E. quagga boehmi*.

NMP 56958; complete skin. **O**: *Equus burchelli boehmi* ♀, a.n. 56/91; Dvůr Králové Zoo, DK 494, juvenile. **N**: *E. quagga boehmi*.

NMP 93399; complete juvenile skull (second molars finishing the eruption), pelvis and sacrum; all incisors isolated (altogether 11 teeth). CL=429, GB=174, ML=356. **O**: *Equus burchelli boehmi* ♀, 30 April 1984, a.n. 66/91; Dvůr Králové Zoo, DK 662. **N**: *E. quagga boehmi*. Age estimation: 2–2.5 years (Červený et al. 1999). Arcus zygomaticus (S) with coarse structure ("exostoses"), perhaps as an effect of fracture.

NMP 93404; complete juvenile skull (third molars erupting). CL=481, GB=186, ML=400. **O**: *Equus burchelli boehmi* ♂, 8 September 1970, a.n. 66/91; Dvůr Králové Zoo, DK 21, * Liberec Zoo. **N**: *E. quagga boehmi*. Age estimation: 4.5 years (Červený et al. 1999), 3 years (Klingel & Klingel 1966), 2.5–3 years (Smuts 1974). Bone loss and formation of a new bone in the condylar mandibular process (S) observable. Sharp protuberance below the condylar mandibular process (S).

NMP 93406; complete skull, third upper incisor (D) absent. Number of supra-orbital foramina: one foramen on both sides. Canines: absent. Infundibulum of the lower incisors: only some traces, absent in general. CL=470, GB=185, ML=391. **O**: *Equus burchelli boehmi*, a.n. 66/91; Dvůr Králové Zoo, DK 19. **N**: *E. quagga boehmi*. Age estimation: 10 years (Červený et al. 1999), 9–11 years (Klingel & Klingel 1966), 11 years (Smuts 1974).

NMP 93407; complete juvenile skull (first molars finishing the eruption process, second molars in evidence), fracture behind the orbit (D). CL=456, GB=184, ML=378. **O**: *Equus burchelli boehmi* ♀, 16 May 1990, a.n. 66/91; Dvůr Králové Zoo, DK 1/214, * Dvůr Králové Zoo, age 1 year, 4 months. **N**: *E. quagga boehmi*.

NMP 93413; complete skull. Number of supra-orbital foramina: one foramen on both sides. Canines: very small. Infundibulum of the lower incisors: absent. CL=467, GB=188, ML=393. **O**: *Equus burchelli boehmi* ♀, 30 July 1984, a.n. 66/91; Dvůr Králové Zoo, DK 677, purchased from van den Brink on 11 November 1983. **N**: *E. quagga boehmi*. Age estimation: 4.5 years (Červený et al. 1999), 1.5–2 years (Klingel & Klingel 1966), 1.5 years (Smuts 1974).

NMP 93421; complete skull. Diastema formation: 1 (Bendrey 2007a); number of supra-orbital foramina: two foramina on both sides. Canines: very small – absent. Infundibulum of the lower incisors: absent.

CL=458, GB=183, ML=383. **O**: *Equus burchelli boehmi* ♀, 24 July 1977, a.n. 66/91; Dvůr Králové Zoo, DK 117, wild caught in 1975. **N**: *E. quagga boehmi*. Age estimation: 7 years (Červený et al. 1999), 5–9 years (Klingel & Klingel 1966), 8–9 years (Smuts 1974).

NMP 93426; complete skull, lower cheektooth rows not compact (zigzag shifts of teeth labially or lingually). Wolf tooth: present (D), number of supra-orbital foramina: 1(S)/2(D). Canines: very small – absent. Infundibulum of the lower incisors: absent. CL=498, GB=197, ML=412. **O**: *Equus burchelli boehmi* ♀, 12 May 1980, a.n. 66/91; Dvůr Králové Zoo, DK 361, wild caught in 1969, age 13 years. **N**: *E. quagga boehmi*.

NMP 93435; complete skull. Wolf tooth: present (D), number of supra-orbital foramina: one foramen on both sides. Canines: small. Infundibulum of the lower incisors: absent. CL=460, GB=197, ML=384. **O**: *Equus burchelli boehmi* ♀, 16 February 1982, a.n. 66/91; Dvůr Králové Zoo, DK 537, wild-caught on 2 July 1974, Kenya, adult. **N**: *E. quagga boehmi*. Age estimation: 10–12 years (Červený et al. 1999), 7–9 years (Klingel & Klingel 1966), 11 years (Smuts 1974).

NMP 95164; complete juvenile skull (first molars starting the eruption). CL=407, GB=175, ML=338. **O**: *Equus burchelli boehmi* ♀, 4 April 1981; Dvůr Králové Zoo, DK 465, age 1 year. **N**: *E. quagga boehmi*.

NMP 95165; complete juvenile skull (second molars erupting), partly healed fracture on the lingual side of the right mandible (between the third and fourth premolars). CL=437, GB=168, ML=358. **O**: *Equus burchelli boehmi* ♂, 18 November 1984; Dvůr Králové Zoo, DK 690, age 5 years 8 months. **N**: *E. quagga boehmi*.

NMP 95166; complete juvenile skull (first molars finishing the eruption, second molars in evidence). CL=446, GB=171, ML=368. **O**: *Equus burchelli boehmi* ♀, 14 May 1989; Dvůr Králové Zoo, DK 1/57, age 1 year. **N**: *E. quagga boehmi*.

NMP 95167; complete juvenile skull (first molars starting the eruption, second molars in evidence), one large hole including nasal and frontal bones (D). CL=419, GB=170, ML=337. **O**: *Equus burchelli boehmi* ♀, 11 May 1976; Dvůr Králové Zoo, DK 47. **N**: *E. quagga boehmi*. Age estimation: 9 months (Červený et al. 1999), 1.5 years (Klingel & Klingel 1966), 6–9 months (Smuts 1974), 1 year (Joubert 1972). Angulus mandibulae (S) with a narrow protuberance on the labial surface.

NMP 95168; pelvis and sacrum. **O**: *Equus burchelli boehmi*, 12 April 1979; Dvůr Králové Zoo, age 10 months. **N**: *E. quagga boehmi*.

DKZ [**unnumbered**]; complete skull, advanced tooth wear, first molar (D) very high, compressing the counterpart tooth in mandible. Number of supra-orbital foramina: one foramen on both sides. Canines: large. Infundibulum of the lower incisors: detectable. CL=477, GB=198, ML=393. **O**: *Equus burchellii boehmi* ♂, Izotop, * ~1982 (Ramatgan), † 22 March 2005 (Dvůr Králové Zoo). **N**: *E. quagga boehmi*.

Equus quagga borensis Lönnberg, 1921

NMP 47359; complete juvenile skull (all premolars erupted, first molars in evidence). CL=281, GB=123, ML=228. **O**: *Equus burchelli boehmi*; maneless ♂, 3 October 1988, a.n. 66/91; Dvůr Králové Zoo, DK 985, * Dvůr Králové Zoo, age 24 days. **N**: *E. quagga borensis*.

NMP 47360; complete juvenile skull (all premolars erupted, first molars in evidence). CL=358, GB=158, ML=293. **O**: *Equus burchelli boehmi* – maneless ♂, 10 March 1978, a.n. 66/91; Dvůr Králové Zoo, DK 197, * Dvůr Králové Zoo (269/76), age 3 months, 15 days. **N**: *E. quagga borensis*.

NMP 47361; complete juvenile skull (all premolars erupted, first molars in evidence). CL=305, GB=125, ML=248. **O**: *Equus burchelli boehmi*; maneless ♂, 21 July 1984, a.n. 66/91; Dvůr Králové Zoo, DK 670, * Dvůr Králové Zoo, age 1 month. **N**: *E. quagga borensis*.

NMP 47611; complete juvenile skull (all premolars erupted, first molars in evidence). CL=262, GB=114, ML=219. **O**: *Equus burchelli boehmi*; maneless ♂, 30 September 1989, a.n. 66/91; Dvůr Králové Zoo, DK 1/89, * Dvůr Králové Zoo. **N**: *E. quagga borensis*. Age estimation: 4 weeks (Červený et al. 1999), few weeks (Klingel & Klingel 1966), 2 weeks – 3 months (Smuts 1974).

NMP 47633; complete juvenile skull (all premolars erupted, first molars in evidence), scapulae and long limb bones. CL=279, GB=116, ML=230. **O**: *Equus burchelli boehmi*; maneless ♂, 31 July 1982, a.n. 66/91; Dvůr Králové Zoo, DK 567, * Dvůr Králové Zoo, age 4 days. **N**: *E. quagga borensis*.

NMP 93087; complete skull and hyoid bones (stylohyoideum), forelimb skeleton (S). Cheektooth rows not compact (upper molars high), first lower molars shifted (left labially, right lingually). Ossification of ligaments between the metapodials: 1c–2 (BENDREY 2007b); number of supra-orbital foramina: 3(S)/2(D). Canines: absent. Infundibulum of the lower incisors: present. CL=489, GB=198, ML=401. **O**: *Equus burchelli boehmi* ♀, maneless, 20 October 1983, a.n. 66/91; Dvůr Králové Zoo, DK 629, wild-caught on 17 May 1969, adult. **N**: *E. quagga borensis*. Age estimation: 12 years (Červený et al. 1999), 9–11 years (Klingel & Klingel 1966), 11 years (Smuts 1974). Hyoid bones associated with the skull by ossification. One narrow and sharp protuberance is oriented from the occipital crest medially to the "sagital crest".

NMP 93096; complete skull, pelvis and sacrum. Number of supra-orbital foramina: one foramen on both sides. Canines: very small. Infundibulum of the lower incisors: minute fused infundibula (Bennett 1980). CL=495, GB=192, ML=420. **O**: *Equus burchelli boehmi*; maneless ♀, 29 June 1982, a.n. 66/91; Dvůr Králové Zoo, DK 548, wild-caught in 1969, adult. **N**: *E. quagga borensis*. Age estimation: 8 years (Červený et al. 1999), 7–9 years (Klingel & Klingel 1966), 8–9 years (Smuts 1974). Caught probably in Karamoja, Uganda (the site of origin of all maneless zebras bred in the Dvůr Králové Zoo).

NMP 93128; complete skull, sacrum and pelvis; first lower molar (S) absent, first lower molar (D) shifted labially. Diastema formation: 1 (Bendrey 2007a); number of supra-orbital foramina: two foramina on both sides. Canines: very small. Infundibulum of the lower incisors: present. CL=480, GB=187, ML=403. **O**: *Equus burchelli boehmi* ♀, 26 September 1986, a.n. 66/91; Dvůr Králové Zoo, DK 821, wild-caught in Uganda on 17 May 1969, age 19 years. **N**: *E. quagga borensis*. Caught probably in Karamoja, Uganda (the site of origin of all maneless zebras bred in the Dvůr Králové Zoo).

NMP 93400; complete juvenile skull (third molars starting the eruption). CL=462, GB=193, ML=385. **O**: *Equus burchelli boehmi* ♀, 7 September 1984, a.n. 66/91; Dvůr Králové Zoo, DK 679, * Dvůr Králové Zoo, age 3 years, 1 month. **N**: *E. quagga borensis*.

NMP 93401; complete skull. Diastema formation: 1 (Bendrey 2007a); wolf tooth: present (both sides), number of supra-orbital foramina: one foramen on both sides (or 2(S)/3(D) if minute foramina counted). Canines: very small – absent. Infundibulum of the lower incisors: absent. CL=494, GB=196, ML=411. **O**: *Equus burchelli boehmi*; maneless ♀, 27 September 1976, a.n. 66/91; Dvůr Králové Zoo, DK 71, wild-caught in Karamoja, Uganda, on 17 May 1969, age 7 years. **N**: *E. quagga borensis*.

NMP 93403; complete skull, apical parts of both nasal bones broken (and not preserved). Diastema formation: 1 (Bendrey 2007a); wolf tooth: present (both sides), number of supra-orbital foramina: one foramen on both sides. Canines: absent. Infundibulum of the lower incisors: absent. CL=480, GB=185, ML=400. **O**: *Equus burchelli boehmi*; maneless ♀, 30 July 1970 a.n. 66/91; Dvůr Králové Zoo, DK 14, wild-caught in Karamoja, Uganda, on 17 May 1969, age 2 years. **N**: *E. quagga borensis*.

NMP 93405; complete skull. Wolf tooth: present (both sides), number of supra-orbital foramina: one foramen on both sides. Canines: very small – absent. Infundibulum of the lower incisors: absent. CL=491, GB=190, ML=491. **O**: *Equus burchelli boehmi*; maneless ♀, 17 January 1973, a.n. 66/91; Dvůr Králové Zoo, DK 16, wild caught in Karamoja, Uganda, age 4 years. **N**: *E. quagga borensis*. Narrow bone bridge on the lingual/inner side of the angular mandibular process.

Fig. 5. Skull of a juvenile male of the maneless zebra, *E. quagga borensis* (NMP 93432).
Obr. 5. Lebka mladého samce zebry bezhřívé (*Equus quagga borensis*; NMP 93432).

NMP 93409; complete skull. Diastema formation: 2 (Bendrey 2007a); wolf tooth: on both sides; number of supra-orbital foramina: one foramen on both sides. Canines: small. Infundibulum of the lower incisors: absent. CL=495, GB=194, ML=417. **O**: *Equus burchelli boehmi*; maneless ♀, 28 September 1972, a.n. 66/91; Dvůr Králové Zoo, DK 13, wild caught in Karamoja, Uganda, on 31 August 1969. **N**: *E. quagga borensis*. Age estimation: 4.5 years (Červený et al. 1999), 4 years (Klingel & Klingel 1966), 5 years (Smuts 1974).

NMP 93412; complete juvenile skull (second molars erupting), first upper incisors isolated. CL=458, GB=193, ML=382. **O**: *Equus*, maneless ♂, 4 December 1990, a.n. 66/91; Dvůr Králové Zoo, DK 1/244, * Dvůr Králové Zoo, age 1 year, 8 months. **N**: *E. quagga borensis*.

NMP 93414; complete skull, fourth lower premolars and first lower molar (D) isolated. Diastema formation: 1 (Bendrey 2007a); number of supra-orbital foramina: one foramen on both sides. Canines: small. Infundibulum of the lower incisors: some traces. CL=473, GB=192, ML=392. **O**: *Equus burchelli boehmi*; maneless ♀, 4 July 1984, a.n. 66/91; Dvůr Králové Zoo, DK 669, wild-caught on 17 May 1969, adult. **N**: *E. quagga borensis*. Age estimation: 10–12 years (Červený et al. 1999), 9–11 years (Klingel & Klingel 1966), 11 years (Smuts 1974). Caught probably in Karamoja, Uganda (the site of origin of all maneless zebras bred in the Dvůr Králové Zoo).

NMP 93418; complete skull. Diastema formation: 0–1 (Bendrey 2007a); wolf tooth: on one side (S); number of supra-orbital foramina: one foramen on both sides. Canines: large. Infundibulum of the lower

incisors: absent. CL=480, GB=194, ML=392. **O**: *Equus burchelli boehmi*; maneless ♂, 25 September 1976, a.n. 66/91; Dvůr Králové Zoo, DK 73, wild caught in Karamoja, Uganda, on 26 May 1970, age 8 years. **N**: *E. quagga borensis*. One protuberance present on the labial side of the mandible (S), specifically in the angular process region.

NMP 93416; complete skull. Diastema formation: 1–2 (Bendrey 2007a); wolf tooth: present (both sides), number of supra-orbital foramina: one foramen on both sides. Canines: very small. Infundibulum of the lower incisors: absent. CL=492, GB=192, ML=405. **O**: *Equus burchelli boehmi*; maneless ♀, 28 September 1972, a.n. 66/91; Dvůr Králové Zoo, DK 15, wild-caught in eastern Uganda, age 4 years. **N**: *E. quagga borensis*. Angulus mandibulae (D) abraded.

NMP 93417; complete skull. Diastema formation: 2 (Bendrey 2007a); wolf tooth: present (D), number of supra-orbital foramina: one foramen on both sides. Canines: very small. Infundibulum of the lower incisors: absent. CL=496, GB=192, ML=425. **O**: *Equus burchelli boehmi*; maneless ♀, 8 June 1983, a.n. 66/91; Dvůr Králové Zoo, DK 609, * Dvůr Králové Zoo, age 9 years, 6 months, 15 days. **N**: *E. quagga borensis*.

NMP 93420; complete skull. Diastema formation: 0 (except for one small bulb (S)) (Bendrey 2007a); wolf tooth: present (D), number of supra-orbital foramina: one foramen on both sides. Canines: large. Infundibulum of the lower incisors: detectable. CL=504, GB=198, ML=421. **O**: *Equus burchelli boehmi*; maneless ♂, 29 November 1990, a.n. 66/91; Dvůr Králové Zoo, DK 1/232, * Dvůr Králové Zoo, age 9 years, 5 months, 15 days. **N**: *E. quagga borensis*.

NMP 93423; complete juvenile skull (second molars erupting). CL=479, GB=187, ML=396. **O**: *Equus burchelli boehmi* ♀, 28 May 1979 a.n. 66/91; Dvůr Králové Zoo, DK 247, wild-caught at Greek river, Karamoja, Uganda, age 3 years. **N**: *E. quagga borensis*. Angulus mandibulae (D) robust.

NMP 93424; complete skull. Diastema formation: 0–1 (Bendrey 2007a); wolf tooth: on one side (S); number of supra-orbital foramina: one foramen on both sides. Canines: absent. Infundibulum of the lower incisors: absent. CL=471, GB=196, ML=391. **O**: *Equus burchelli boehmi*; maneless ♀, 25 September 1976, a.n. 66/91; Dvůr Králové Zoo, DK 70, wild-caught in Karamoja, Uganda, on 26 May 1970, age 7 years. **N**: *E. quagga borensis*. A broken coronoid process is associated with this specimen, but incorrectly, as both coronoid processes are present and undamaged.

NMP 93427; complete juvenile skull (second molars erupting), rostral part of mandible broken (but preserved), 8 isolated incisors, canines, dorsal part of the braincase cut away (but preserved). CL=438, GB=185, ML×. **O**: *Equus burchelli boehmi*; maneless ♂, 12 April 1979, a.n. 66/91, Dvůr Králové Zoo, DK 252, * Dvůr Králové Zoo, age 10 months. **N**: *E. quagga borensis*.

NMP 93428; complete juvenile skull (second molars erupted, third molars in evidence), second (S), first (D) upper incisors and second (D) lower incisors absent. CL=447, GB=179, ML=375. **O**: *Equus burchelli boehmi*; maneless ♀, 8 February 1976, a.n. 66/91; Dvůr Králové Zoo, DK 17, wild-caught in Karamoja, Uganda, age 5 years (?). **N**: *E. quagga borensis*. Angular process of the mandible (S) shifted labially, maybe as an effect of healed fracture.

NMP 93431; complete skull, sacrum and pelvis, several vertebrae. Wolf tooth: one (D); number of supra-orbital foramina: two foramina on both sides. Canines: very small. Infundibulum of the lower incisors: minute. CL=469, GB=193, ML=390. **O**: *Equus burchelli boehmi*; maneless ♀, 17 January 1985, a.n. 66/91; Dvůr Králové Zoo, DK 696, wild-caught in Uganda on 22 June 1976. **N**: *E. quagga borensis*. Age estimation: 7 years (Červený et al. 1999), 4–5 years (Klingel & Klingel 1966), 5 years (Smuts 1974).

NMP 93432; complete juvenile skull (first molars erupting). CL=413, GB=175, ML=342. **O**: *Equus burchelli boehmi*; maneless ♂, 11 April 1979, a.n. 66/91; Dvůr Králové Zoo, DK 318, age 9 months. **N**: *E. quagga borensis*. Angulus mandibulae (D) robust (Fig. 5).

NMP 93433; complete juvenile skull (first molars erupted, second molars in evidence). CL=448, GB=185, ML=371. **O**: *Equus burchelli boehmi*; maneless ♂, 28 August 1982, a.n. 66/91; Dvůr Králové Zoo, DK 580, * Dvůr Králové Zoo, age 1 year, 4 months. **N**: *E. quagga borensis*.

NMP 93436: complete skull. Number of supra-orbital foramina: two foramina on both sides; wolf tooth: both sides. Canines: very small, absent in general. Infundibulum of the lower incisors: absent. CL=473, GB=192, ML=398. **O**: *Equus burchelli boehmi*; maneless ♀, 27 September 1976, a.n. 66/91; Dvůr Králové Zoo, DK 72, wild-caught in Karamoja, Uganda, on 26 May 1970, age 7 years. **N**: *E. quagga borensis*.

NMP 94274; complete juvenile skull (only all premolars fully erupted), several cervical vertebrae. CL=371, GB=153, ML~300. **O**: *Equus burchelli boehmi*; maneless ♀, 6 October 1983; Dvůr Králové Zoo, DK 633, age 4 months 15 days. **N**: *E. quagga borensis*.

NMP 94953; complete skull; first upper incisor (D) absent. Wolf tooth: present (S); number of supra-orbital foramina: two foramina on both sides. Canines: small. Infundibulum of the lower incisors: absent. CL=469, GB=192. **O**: *Equus burchelli boehmi*; maneless ♀, 16 January 1978; Dvůr Králové Zoo, DK 203, adult. **N**: *E. quagga borensis*. Age estimation: 12 years (Červený et al. 1999), 9–11 years (Klingel & Klingel 1966), 10–11 years (Smuts 1974). A partially healed fracture of the left occipital crest.

NMP 95169; complete skull, rostrum with two lower incisors (D) broken, first lower incisor (D) with an exposed rooth. Diastema formation: 0–1 (Bendrey 2007a); present (S); number of supra-orbital foramina: one foramen on both sides. Canines: very small – absent. CL=477, GB=189, ML~410. **O**: *Equus burchelli boehmi*; maneless ♀, 4 April 1978; Dvůr Králové Zoo, DK 160, age 8 months 15 days (?). **N**: *E. quagga borensis*.

NMP 95170; complete skull, postcranial skeleton, cheektooth rows not compact (zigzag shifts of particular teeth labially/lingually). Wolf tooth: present (both sides); number of supra-orbital foramina: 2(S)/1(D). Canines: very small. Infundibulum of the lower incisors: absent. CL=501, GB=199, ML=416. **O**: *Equus burchelli boehmi*; maneless ♂, 8 March 1987; Dvůr Králové Zoo, DK 865, age 12 years. **N**: *E. quagga borensis*. Supranumerary upper incisors (two instead of one second incisor; D).

NMP 95171; complete juvenile skull (first molars finishing the eruption, second molars in evidence). CL=453, GB=183, ML=380. **O**: *Equus burchelli boehmi*; maneless ♂, 7 December 1990; Dvůr Králové Zoo, DK 1/233, age 1 year 4 months. **N**: *E. quagga borensis*. Angulus mandibulae (S) more robust than (D) (in the posterior view).

NMP 95172; complete juvenile skull (second molars finishing the eruption), altogether four incisors absent, two isolated. CL=472, GB=185, ML=394. **O**: *Equus burchelli boehmi*; maneless; Dvůr Králové Zoo, DK 23. **N**: *E. quagga borensis*. Age estimation: 2–2.5 years (Červený et al. 1999), 3 years (Klingel & Klingel 1966), 1.5–2 years (Smuts 1974), 2–2.5 years (Joubert 1972).

NMP 95173; complete skull. Diastema formation: 0–1 (Bendrey 2007a); wolf tooth: on both sides; number of supra-orbital foramina: one foramen on both sides. Canines: very small. CL=499, GB=189, ML=416. **O**: *Equus burchelli boehmi*; maneless ♀, 23 December 1984; Dvůr Králové Zoo, DK 698. **N**: *E. quagga borensis*. Age estimation: 8 years (Červený et al. 1999), 7–9 year (Klingel & Klingel 1966), 6–7 years (Smuts 1974), 7–9 years (Joubert 1972).

NMP 95174; complete skull and hyoid bones, postcranial skeleton, advanced tooth wear, not compact cheektooth rows (fourth upper premolar (D) and fourth lower premolar (S) shifted labially). Number of supra-orbital foramina: one foramen on both sides. Canines: very small – absent. Infundibulum of the lower incisors: present. CL=481, GB=199, ML=416. **O**: *Equus burchelli boehmi*; maneless; Dvůr Králové Zoo, DK 835. **N**: *E. quagga borensis*. Age estimation: 16 years (Červený et al. 1999), 12–14 years (Klingel & Klingel 1966), 14 years (Smuts 1974).

DKZ [**unnumbered**]; complete skin, hooves absent. **O**: maneless zebra ♂. **N**: *E. quagga borensis*.

DKZ [**unnumbered**]; complete skull, advanced tooth wear, cheektooth rows not compact, first lower molars absent. Number of supra-orbital foramina: one foramen on both sides. Canines: small. Infundibulum of the lower incisors: present. CL=483, GB=189, ML=415. **O**: *Equus burchellii borensis* ♀, Katy, * 9 April 1984 (Dvůr Králové Zoo), † 4 February 2008 (Dvůr Králové Zoo). **N**: *E. quagga borensis*.

DKZ [**unnumbered**]; complete skull, advanced tooth wear, second lower molars much higher than usual, these lower molars abraded. Diastema formation: 2 (Bendrey 2007a); number of supra-orbital foramina: one foramen on both sides. Canines: large. Infundibulum of the lower incisors: present. CL=483, GB=197, ML=400. **O**: *Equus burchellii borensis* ♂, Speed, * 12 June 1985 (Lešná Zoo, CR), † 2 June 2007 (Dvůr Králové Zoo). **N**: *E. quagga borensis*.

Equus quagga Boddaert, 1785 ssp.

NMP 10797; complete skull. Number of supra-orbital foramina: 2(S)/1(D). Canines: absent. CL=462, GB=183, ML=378. **O**: *Equus grevyi* ♀, n. 3975. **N**: *E. quagga*. Age estimation: 4.5 years (Červený et al. 1999), 4 years (Klingel & Klingel 1966), 4 years (Smuts 1974), 3.5 years (Joubert 1972).

NMP 95175; complete "juvenile" (third molars finishing the eruption) skull and hyoid bones, postcranial skeleton, perforations in the middle portion of both nasal bones. Diastema formation: 0–1 (Bendrey 2007a); number of supra-orbital foramina: 1(S)/1–3(D). Canines: large. CL=481, GB=185, ML=400. **O**: zebra, 16 February 2010, KK1 2/2. **N**: *E. quagga*. Age estimation: 3 years (Červený et al. 1999), 3? years (Klingel & Klingel 1966), 3.5 years (Smuts 1974).

NMP 95176; complete skull, postcranial skeleton (long limb bones, scapulae, dissociated pelvis), third upper incisors absent. Diastema formation: 4! (Bendrey 2007a); wolf tooth: on one side (D); number of supra-orbital foramina: one foramen on both sides. Canines: very small – absent. Infundibulum of the lower incisors: absent. CL=452, GB=175, ML=376. **O**: horse, Hloubětín and Peruc depository buildings, corrected by Eisenmann (1997) as "14 July 1987 – *E. burchelli* (northern subspecies)". **N**: *E. quagga*, northern complex. Age estimation: 7 years (Červený et al. 1999), 4 years (Klingel & Klingel 1966), 5 years (Smuts 1974).

NMP 95177; complete skull. Number of supra-orbital foramina: 2(S)/1–2(D). Canines: very small – absent. Infundibulum of the lower incisors: absent. CL=492, GB=203, ML=407. **O**: 878. **N**: *E. quagga*, perhaps from Dvůr Králové Zoo (judging by the style of inscriptions). Age estimation: 3.5 years (Červený et al. 1999), 3.5 years (Klingel & Klingel 1966), 3.5 years (Smuts 1974), 3 years (Joubert 1972).

DKZ 105827; complete skin, hooves absent. **O**: n. 566. **N**: *E. quagga boehmi* or *E. q. borensis*.

DKZ 105833; complete skin, hooves absent. **O**: n. 565. **N**: *E. quagga boehmi* or *E. q. borensis*.

DKZ 111839; complete juvenile skull (second molars erupting). CL=466, GB=182, ML=375. **O**: *Equus quagga boehmi* ♀. **N**: *E. quagga*. Age estimation: 9–12 months (Červený et al. 1999), 1.5 years (Klingel & Klingel 1966), 1–1.5 years (Smuts 1974).

DKZ 113362; complete skull, second and third upper incisors (D) smaller and with less wear than the left counterparts. Diastema formation: 0–1 (Bendrey 2007a); number of supra-orbital foramina: one foramen on both sides. Canines: large. Infundibulum of the lower incisors: absent. CL=476, GB=188, ML=405. **O**: absent. **N**: *E. quagga*. Age estimation: 9 years (Červený et al. 1999), 7–9 years (Klingel & Klingel 1966), 10 years (Smuts 1974).

DKZ [without number]; complete skull, advanced tooth wear. Wolf tooth: present (S), number of supra-orbital foramina: 1–3(S)/1(D). Canines: large. Infundibulum of the lower incisors: absent. CL=507,

GB=191, ML=416. **O**: absent. **N**: *E. quagga* (plains zebra), perhaps southern complex. Age estimation: 20 years (Červený et al. 1999), 15–18 years (Klingel & Klingel 1966), 14 years (Smuts 1974).

Equus cf. *quagga* ssp.

NMP 95178; complete juvenile skull (second molars erupting), only third lower incisor present from all incisors. CL=434, GB=169, ML=363. **O**: 18 or 78, n. 3. **N**: *E.* cf. *quagga*, perhaps from Dvůr Králové Zoo (judging by the style of inscriptions). Age estimation: 2–2.5 years (Červený et al. 1999).

NMP 95179; complete juvenile skull (second molars erupting), partly healed fracture on the lingual side of the right mandible (between the third and fourth premolars). CL=437, GB=168, ML=358. **O**: 690. **N**: *E.* cf. *quagga*, perhaps from Dvůr Králové Zoo (judging by the style of inscriptions). Age estimation: 12 months – 2 years (Červený et al. 1999), 1.5 years (Klingel & Klingel 1966), 1–1.5 years (Smuts 1974).

Equus sp.

NMP 94952; skull without mandible, premaxilla broken, dorsal part of the braincase bilaterally perforated. **O**: *Equus* adult, subfossil, Sadská, near Neuro Sanatorium 5 m in a swamp (excavated), Roman Bajčan, Mánesova 20, Praha 2, 25 March 1976. **N**: *Equus* sp. (horse), eastern group (see Groves 1974). Age estimation: more than 4.5 years (Červený et al. 1999).

NMP 24/2014/33; metatarsus (S); ossified ligaments between the metapodials: 2. **O**: *Equus* sp. **N**: *Equus* sp.

NMP 24/2014/34; complete hind limb skeleton (S). **O**: absent. **N**: *Equus* sp.

NMP 24/2014/35; metatarsus (S), ossified ligaments between the metapodials: 2. **O**: *Equus* sp. **N**: *Equus* sp.

NMP 24/2014/36; complete hind limb skeleton (S). **O**: absent. **N**: *Equus* sp.

NMP 24/2014/37; phalanx III (D). **O**: absent. **N**: *Equus* sp.

NMP 24/2014/38; tarsus. **O**: absent. **N**: *Equus* sp.

NMP 24/2014/39; autopodium bones of a forelimb (S). Ossified ligaments between the metapodials: 1b? **O**: 43, left forelimb. **N**: *Equus* sp.

NMP 24/2014/40; autopodium bones of a forelimb (S), without carpals. **O**: absent. **N**: *Equus* sp.

NMP 24/2014/41; autopodium bones of the hind limb (D) without tarsus. Ossified ligaments between the metapodials: 1c. **O**: right hind limb, 22, Frič. **N**: *Equus* sp.

Additional notes

NMP. We were not able to localise the following specimens mentioned in the inventory books: (a) *Equus przewalskii* (♂, 120 Washington 1 "Horymír"), considered lost for a long time (Volf 2010b); (b) *E. przewalskii* (♀, 75 Praha 8 "Vlasta"), considered lost for a long time (Volf 2010b); (c) *E. hemionus kulan* (♀, 25 years old, skull), mentioned and measured by Volf (2010b).

On the other hand, we localised the skull of *E. przewalskii* (♀, 471 Praha 100 "Artemis") and probably also the skull and postcranial skeleton of *E. przewalskii* (♂, 92 Praha 25 "Leo"); both specimens were considered missing by Volf (2010b).

DKZ. The skins DKZ 10826 *E. quagga burchellii* (Damara zebra) and DKZ 105800 (n. 195) *E. hartmannae* (based on the catalogue of Dvůr Králové Zoo) were not localised during our research. Additionally, several mounted head skins of equids are displayed in the exhibition hall of the Zdeněk Burian Gallery,

Table 1. Numbers of wild equid specimens in the revised collections
Tab. 1. Počet divokých koňovitých v revidovaných sbírkách

taxon	NMP	DKZ	HMS	total
Equus przewalskii	39	0	7	46
Equus cf. *przewalskii*	0	0	1	1
Equus africanus somaliensis	3	0	0	3
Equus kiang holdereri	3	0	0	3
Equus hemionus kulan	6	0	0	6
Equus hartmannae	29	2	0	31
Equus grevyi	46	3	0	49
Equus quagga burchellii	22	2	0	24
Equus quagga chapmani	17	2	0	19
Equus quagga boehmi	18	1	0	19
Equus quagga borensis	35	3	0	38
Equus quagga spp.	4	5	2	11
Equus cf. *quagga* spp.	2	0	0	2
Equus sp.	10	0	13	23
total	234	18	23	275

Dvůr Králové Zoo, specifically: *E. africanus somaliensis*, *E. hartmannae*, *E. grevyi*, *E. quagga boehmi*, *E. q. borensis*, *E. q. chapmani*. No data on these specimens are available.

DISCUSSION

Nature of collections

In summary, three revised major collections (NMP, DKZ, HMS) contained 275 specimens of seven species and seven subspecies of equids under the taxonomy following Groves & Grubb (2011), see Table 1. Albeit the HMS collection was not included in detail in this catalogue, basic information is briefly noted for comparison with other collections.

Most of the collections revised were created as a systematic equid collection and include individuals of the domestic forms or the wild forms kept in captivity. However, many individuals of the wild equids kept in zoos were wild-caught (e.g. many of the DKZ originating specimens of *E. quagga borensis* and *E. grevyi*) or derived by a few generations only from wild-born founders (e.g. *E. kiang holdereri*, *E. hemionus kulan*, *E. przewalskii*).

A significant number of the NMP specimens was originally a property of the famous company trading with nature products owned by Václav Frič (1839–1916) from Prague (a brother of a prominent zoologist Professor Antonín Frič), and was bequeathed to the National Museum by Frič's nephew Jaroslav in the late 1950s (Štěpánek 1975). This selection was not primarily created as a scientific collection and the specimens mostly lack any associated data on their origin and taxonomic affiliation. Some valuable specimens housed in the National Museum Prague and Hippological Museum Slatiňany originate from the state confiscations of the "burgeois" properties in the early post-WWII period. More recently, additional material was obtained due

to cooperation between the respective museums and several zoological gardens, namely Dvůr Králové Zoo and Prague Zoo (see Heráň et al. 1992, Anděra 2001).

The history of the HMS collection, including the collection of horse specimens, was summarised by Havlíček (2000) and Gotthardová & Bílek (2012). In general, it was created by fusion of many collections confiscated after the WWII with the aim to demonstrate horses from the palaeontological, zoological, anatomical, and cultural points of view.

Most of the available specimens associated with the DKZ breeding and keeping programmes were donated to the NMP collection, but several specimens still remain in the DKZ for educative and comparative purposes. The majority of recently acquired skull material was gathered by one of the authors (LČ). Some of the above listed specimens originating from the DKZ lack detailed individual- or taxa-specific information. The associated numbers are solely the collection identification numbers without any link to numbers used in the breeding management or in studbooks (cf. Čulíková & Hlávka 2010).

Value of the collections

The majority of valuable specimens include the information concerning their origin and/or breeding history. Such material is of a high scientific value and it is interesting from several points of view.

Collections of equid specimens are certainly important for comparative morphological investigations, including e.g. a comparation of the (sub)fossil and extant material (e.g. Tobien 1992), detecting of pathology and anomaly incidence (e.g. Rothschild et al. 2001, Spasskaya 2014), deciphering of equid domestication (e.g Forstén 1988b, Hemmer 1990, Anthony & Brown 1991, Bendrey 2012) and phylogenetic relationships (e.g. Groves & Willoughby 1981, Groves & Ryder 2000, Eisenmann 1986, Eisenmann & Baylac 2000).

Several morphological comparisons of the exterior parameters, skull and mandible shapes or the braincase capacity of wild equids have demonstrated the significant influence of captivity conditions on the morphology of the species investigated (see e.g. Lundholm 1949, Groves 1966, Klimov & Orlov 1982, Volf 1967, 1995b, Spasskaya & Orlov 1999, Spasskaya 2000, 2007, Spasskaya & Kůs 2003, Rossel et al. 2008). The weaker mandible, brain weight and lower braincase capacity, and changed breeding parameters in the Przewalski horses are probably more prominent examples of such "domestic features" (Volf 1989, 1995, Röhrs & Ebinger 1993, 1998).

Morphological comparisons between the wild and domestic equids are also important for detecting the expression of some pathologies in unworked and worked animals (e. g. Bahn 1980, Bendrey 2007a, b, see also Rogers & Rogers 1988).

Moreover, the preserved material of Przewalski horse could be helpful in comparation of several breeding lines. All living Przewalski horses are derived from only 12 pure-bred Przewalski horses and several domestic horses (see below and e.g. Groves 2009, Robovský 2009). Two main lines of the Przewalski horse contributed originally to the preservation of this last wild horse in the world – the A-line (also called the Munich line) and the B-line (also the Prague line), for more details see e.g. Bouman & Bouman (1994). Horses of the two lines are not identical, neither in external appearance nor in genetic traits, and have different histories of introgression (e.g. Groves 2009, Robovský 2009, 2012). Possible influence of domestication on various other morphological characters should be analysed in both lines (Groves 2009) and such information could be important for planning efficient conservation measures in the

Przewalski horse, since the A-line is perilously close to total extinction. This line has played an important role in improving the B-line as it is thought to be without any influence of domestic horse introgressions (for more details and discussions see Groves 2009, Zimmermann 2009, Robovský 2009, 2012).

It could be also noted that captive-originating specimens are not too frequently stored in museums and are often irrecoverably lost (see Groves 1982 for the Asian rhinoceroses). Systematicaly collected specimens of B-Line and M-Line Przewalski horses are comparable in number only with the Askania Nova collection (Zharkikh & Yasynetska 2007, 2009, our observation across various collections).

The NMP housed type specimen of the kulan (*Equus hemionus kulan*), defined by Groves & Mazák (1967), has a great comparative significance in the Asiatic wild ass taxonomy (see Eisenmann & Shah 1996, Schreiber et al. 2000, Nielsen et al. 2007, Schreiber 2007).

All the above mentioned material has been studied by many specialists (see e.g. Bendrey 2007a, b, Heráň 1989, Kratochvíl 1971, Groves & Mazák 1967, Mazák & Dobroruka 1967, Musil 1969, Spasskaya 2000, Volf 1967, 1995a, 2010a, b, V. Eisenmann in litt.).

Wild equids in other collections

Equids are certaily fascinating mammals from many aspects (Groves 1974), their significant presence in the collections in the Czech Republic is connected with a mixture of several factors: (a) education purposes (domestic horse bones and hooves are often present e.g. in basic or high school collections), (b) collecting of valuable specimens for scientific purposes, (c) collecting of trophies.

The first two factors are more important, albeit many specimens or collections of trophies from safaries have been donated to the NMP and other collections, for example by Alex Thurn-Taxis due to the personal iniciative by his safari-leader, Bedřich Machulka (Machulka 1958, Štěpánek 1975, Todorovová 2009). Most of the aristocratic properties in Czechoslovakia were confiscated after the WWII. Many natural history collections were confiscated and concentrated in the National Museum (collections by Riedl, Beaufort, Auersperg-Trauttmannssorf, Thurn-taxis, Hanau-Schaumburg, Böhm, et c., see Štepánek 1975: 122). The confiscations were frequently connected with a loss of the available evidence. In any case, equid material gathered as trophies is relatively rare in the Czech collections – in comparison e.g. with rhinoceroses (see Robovský et al. 2010).

Despite our effort, it is probable that additional valuable material of equids, mainly of domestic equids, could be present in other museum or school collections, and maybe in cabinets of curiosities in various castles. Certain number of valuable specimens is also present in private collections. We would be grateful for any information on such additional material in the Czech Republic. Of course, specimens with a known geograpical origin and age (in the case of captive individuals) are the most valuable.

Here, we briefly list all CR institutions containing a material of wild equids known to us:

(1) Zoological Museum Protivín; skulls of several equid taxa obtained predominantly from the Czech zoological gardens (for photographs of the particular specimens see http://www.krokodylizoo.cz/zoologicke-muzeum), viz. *Equus przewalskii* (Li5), *E. hemionus kulan* (Li3), *E. kiang holdereri* (Li02), *E. q. boehmi* (Li11), *E. q. borensis* (Li10), *E. q. chapmani* (Li15), *E. q. burchellii* (Damara zebra, Li12), *E. grevyi* (Li14), *E. hartmannae* (Li14). Additionally, one complete skin (hooves absent) of *E. grevyi* is present in this collection. The collection of ZMP is a private property associated with the Protivín Crocodile Zoo

and the collection activity of its owner, M. Procházka. The collection comprises ca. 1200 specimens of various taxa.

(2) Moravian Museum, Brno (Budišov depository room, Třebíč Dist.), MMB; Jiří Chalupa, curator of zoology, kindly provided us with information on the specimens of *E. quagga boehmi* housed in the museum: (a) mounted head skin, MMB 18167, leg. Chorinsky; (b) mounted head skin, MMB 230, Athi Plains, Kenya, 29 January 1911, leg. R. Salm; (c) skin (hooves absent), MMB 229, leg. Chorinsky; (d) skin (hooves absent), MMB 231, leg. Chorinsky. The localities of the origin of Chorinsky's specimens of rhinoceroses (Robovský et al. 2010) indicated the origin of the zebras collected by Chorinsky in Kenya or Tanzania, which could suggest the *boehmi* subspecific affiliation of these zebras.

(3) Dr. Emil Holub Memorial – African Museum Holice (Pardubice Dist.); two mounted head skins of *E. buchellii boehmi* (one specimen is prepared with an open mouth) are specified in the digital catalogue (available at http://www.holubovomuzeum.cz/), both specimens were with a certain probability obtained in southern Africa in the period ca. 1875–1888. Theoretically, both specimens could be directly associated with Holub's two journeys to southern Africa. He visited the region for the first time in 1872 and stayed there for seven years and for the second time in 1883 and stayed there for four years (Rozhoň 2005). He spread the collected specimens over various institutions, both museums and local school cabinets (Štěpánek 1975). All specimens collected by his group are connected with southern Africa, the territory between Cape Town, South Africa, and the present Lusaka, Zambia (Rozhoň 2005). However, there is no evidence of a direct link between the specimens displayed in the Holice museum and Holub's collection activities (see also Mlíkovský et al. 2011b).

(4) Telč Castle, Telč (Jihlava Dist.); Hanák (2005) published a catalogue of specimens housed in the African Hall in the Telč Castle that consists of 161 specimens of 50 species (one reptile species, one bird species and 48 species of African and Arabian mammals). The collection was created by Count Karel Podstatzky von Lichtenstein from trophies obtained during his six hunting trips to Africa and Arabia (1902–1914). The collection of many specimens is described in detail in his book (Podstatzky-Lichtenstein 1929). One mounted head skin of a zebra is present in the collection and this specimen remains unspecified geografically in the book (for two photographs see Podstatzky-Lichtenstein 1929: 86–87), although the original tag bears the following text: "*Hippotigris granti*, B. O. A., Nyaroby-River, 21 Jänner 1906".

(5) Bítov Castle, Bítov (Znojmo Dist.); Hanák et al. (1999) published a catalogue of some vertebrates displayed in the Bítov Castle and mentioned one mounted head skin of *Equus quagga boehmi* (No. 1706). The collection of the Bítov Castle consists of many specimens – Hanák et al. (1999) listed 374 mounted preparations of various exotic vertebrates of 251 species and mentioned a presence of some additional specimens of local birds and mammals, domestic animals and also some mammalian skins as trophies. The collection was acquired by Georg Haas von Haselfels (1876–1945) from his private zoo and some specialised shops, but trophies of African mammals were probably acquired by former owners of this castle – the Counts Otokar and Vladimir Dauns during their journey around the world (Hanák et al. 1999, Jan Binder pers. comm.).

(6) Buchlov State Castle (Buchlov); a skin of *Equus grevyi* (the collection remains inaccessible).

(7) Hunting and Forestry Museum Úsov (Šumperk Dist.); the history and catalogue of the HFM collection was published by Hanák et al. (2003). The collection was accumulated by Johann the II von Lichtenstein and consists of 2619 specimens of 518 species. Two mounted head skins of *E. quagga boehmi* are present: (a) ♂, No. Z-956(175/63), Makindo, Kenya, 17 March 1896, leg. H. von Lichtenstein; (b) ♀, Z-958(177/63), Kibobo, Kenya, 21 January 1896, leg. Hans Lichtenstein. Open mouth is prepared in both specimens, infundibulum is present in lower incisors; for photos of both specimens see Hanák et al. (2003: 30).

(8) Třebíč Regional Museum, Třebíč (Třebíč Dist.); one skin od *E. quagga boehmi* (hooves and head absent). Skin of the zebra is probably associated with the collection trips by Rudolf Salm who travelled to Africa and Asia to hunt trophies. This specimen is displayed at the Craft Museum in the Moravské Budějovice Castle (Třebíč Dist).

(9) Brno Zoo, Brno (Brno Dist.); Jana Galová enabled us the access to two specimens: (a) skin of *E. quagga chapmani* (head and hooves absent), No. 1126, (b) complete skull specified as *E. quagga chapmani* with these characters: very advanced tooth wear, several teeth mising – both second upper molars, second lower premolar (D), only small rest of the third upper molar (S) present. Diastema formation: 1 (Bendrey 2007a); number of supra-orbital foramina: 2 (S) / 4 (D). Canines: absent. BL~435. Based on our examination and the archive evidence, this specimen belongs to *E. hemionus kulan* (* 18 May 1982, † 7 November 2007).

(10) Jihlava Zoo, Jihlava (Jihlava Dist.); mounted specimen (foal) of *E. quagga burchellii* (Damara zebra) is displayed in an education room.

(11) North Bohemian Zoo, Liberec (Liberec Dist.); Lubomír Melichar kindly provided us with information on five specimens: (a) skull of *E. africanus somaliensis* (♀ Diana, * 1991, † 1996), (b) skull of *E. quagga chapmani* (♀ Mata Hari), (c) three skins of *E. quagga chapmani*, one of them atypically dark-coloured (more details will be noted in a separate catalogue focused on mammals in collection of the Liberec Zoo, Robovský & Melichar, in prep., also Janeček 1986)

(12) Olomouc Zoo (Olomouc Dist.); Jitka Vokurková kindly provided us with information on one specimen: mounted head skin of *E. quagga chapmani* (♀, * 27 July 2004, Bojnice Zoo (Slovakia), † Olomouc Zoo, age: 2 years 9 months 23 days, SNr 398).

(13) Ostrava Zoo (Ostrava Dist.); Jan Pluháček kindly provided us with information on the following specimens: two skins and one skull of *Equus grevyi*, with no data associated.

(14) Plzeň Zoo; Lenka Václavová kindly provided us with information on six zebra specimens: (a) complete skin of *E. quagga chapmani*, (b) mounted head skin of *E. quagga chapmani*, (c) mounted head skin of *E. quagga boehmi* (♂ Lohn, No. 356/03), (d) three complete skins (hooves absent) of *E. quagga boehmi*.

(15) Prague Zoo (Praha Dist.); seven specimens of *E. przewalskii*: (a) skull, ♂ Garp (SNr 3563, M-Line), (b) skull, ♀ Xara (SNr 3910, M-Line), (c) skull, ♀ Gája (SNr 3515, M-Line), (d) mounted skin, ♀ Fauna (SNr 631, Ee, M-Line), (e) skull, ♀ Nágya (SNr 5798, M-Line), (g) skull, ♀ Nimfa (SNr 5789, M-Line), skull, ♂ Nick (SNr 1135, M-Line). For details see Kůs (2010).

(16) Czech Environmental Inspectorate: one skin of *Equus hartmannae* confiscated in the 2000s.

Concering the completeness of this catalogue, it should be noted that some remains of wild equids are deposited in the Hippological Musem Slatiňany: an adult skull and a juvenile skull of the plains zebra (HMS 15, HMS 99), a zebra embryo (in liquid, unnumbered), a skull and a skin of *E. przewalskii* (Chrudimka, SNr 2994, M-Line), a juvenile skull of *E. przewalskii* (HMS 216, perhaps Leo, SNr 92, A/B-Line), a mounted head skin of *E. przewalskii* (♂ Simon, SNr 411, A-Line) and a complete skin of *E. przewalskii* (Yper, SNr 2500, M-Line), three mounted skins of *E. przewalskii* (Ali – SNr 62, B-Line, Minka – SNr 65, B-Line, and ♀ Praha 1 – SNr 68, B-Line), a skull of the hybrid of Przewalski and domestic horses (HMS 72; identified by Spasskaya 2000), and three skulls (HMS 130, two unnumbered) with similarities to Przewalski and domestic horses. More details will be published elsewhere (Robovský et al. 2014), together with a catalogue of domestic equids in the Czech collections. We expect some (trophy) material of wild equids to be present in some other castles (Konopiště, Opočno) and in the Teplice Regional Museum (Bohuslav Boček, pers. comm.), but these specimens remain unexamined.

SOUHRN

Katalog divokých zástupců koňovitých se snaží podchytit většinu zejména osteologického materiálu těchto zajímavých a krásných savců v České republice, a to na základě publikovaných katalogů, dotazníkových akcí a revizí hlavních sbírek. Katalog zmiňuje 275 sbírkových jedinců sedmi druhů a sedmi klasicky

rozlišovaných poddruhů. Za nejvýznamnější sbírky lze považovat sbírku Národního muzea v Praze, Hippologického muzea ve Slatiňanech, Zoo Dvůr Králové a Zoologického muzea v Protivíně. Tři ze čtyř nejvýznamnějších sbírek (kromě Hippologického muzea Státního zámku Slatiňany) obsahují řadu v lidské péči narozených divokých zástupců koňovitých, kteří mohou být využitelní pro vysledování vlivu lidské péče na jejich somatické parametry a kalibraci archeologických pohledů na domestikaci koňovitých. Sbírky Národního muzea, pražské zoo a Hippologického muzea zahrnují velké množství koní Převalského, s geny tzv. B-linie, Národní museum pak navíc holotyp a paratyp kulana (*Equus hemionus kulan*). Většina zde specifikovaného materiálu má tedy značnou vědeckou hodnotu.

ACKNOWLEDEGMENTS

We would like to gratefully thank Bohuslav Boček (Teplice Regional Museum), Jaroslav Bušta (Hippological Museum, Slatiňany), Jana Galová & Ilona Pšenková (Brno Zoo), Tomáš Hajnyš & Ilona Kratochvílová (Dvůr Králové Zoo), Jiří Chalupa (Moravian Museum Brno), Michaela Jerhotová (Ohrada Zoo), Luboš Melichar (Liberec Zoo), Bohumil Norek (Telč Castle), Drahomíra Nováková (Municipal Museum and Library, Čáslav), Václav Páral & Martin Pyszko (Faculty of Veterinary Medicine, University of Veterinary and Pharmaceutical Sciences, Brno), Pavlína Peřinková & Michal Zábrš (Třebíč Regional Museum), Jan Pluháček (Ostrava Zoo), Miroslav Procházka (Zoological Museum, Protivín), Václav Seichert & Michaela Banszelová (First Faculty of Medicine, Charles University, Prague), Marco Stella (Hrdlička Museum of Man, Prague), Dušan Trávníček (Museum of South-Eastern Moravia, Zlín), Eva Třísková (Museum of Hunting and Forestry, Úsov), Lenka Václavová (Plzeň Zoo), Jan Vašák (Jihlava Zoo), Vladimír Vohralík (Faculty of Science, Charles University, Prague), Jitka Vokurková (Olomouc Zoo), and Marie Voldřichová (Faculty of Science, University of South Bohemia, České Budějovice) for providing us with very valuable information about the specimens and/or access to collections and/or support in various ways, and Karel Kadeřábek (NMP) for his important technical help.

We are grateful to Colin P. Groves (Australian National University, Canberra) for his help with determination of several specimens (Przewalski horse × domestic horse). The first author would like to hugely thank Colin P. Groves, and Gertrud and Helmut Denzaus for their brilliant books, *Horses*, *Asses and Zebras in the Wild* and *Wildesel* which provided us with extraordinarily valuable information, beauty of equids and enthusiasm in our activities.

The preparation of this work was supported by grants of the Ministry of Culture of the Czech Republic (# DKRVO 2014/14, 00023272) and the Ministry of Education, Youth and Sports of the Czech Republic (# 6007665801).

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