### ****Cedar Meadow Spring (Itchetucknee), Rancholabrean****

1. Accepting the Rancholabrean cranium from Cedar Meadow FAM 116143 (Fig.1) as the lectotype of *E. fraternus*, the following observations can be made. 
 The specimen lacking part of the occiput, there is no saying if the vertex length was, as in *Amerhippus*, long relative to the basilar length. 
 For the same reason the length of the posterior ocular line relative to the anterior one is unknown. 
 Fortunately the palatal length and the vomer-palate distance can be measured. Their proportions are like in *Amerhippus* (Fig.2). 
 Like in Amerhippus also, the cheek length is long relative to the naso-incisival notch (Fig.3).
The upper cheek teeth are wrinkled as often in worn specimens. Protocones are moderately long, oblique, and grooved ; plis caballin are present. The type upper little worn premolars of *E. pseudaltidens* are rather alike (Fig.4).
The lower dentition is unknown.

2. From Cedar Meadow there is also posterior fragment of skull FLA 236-3770 (Fig.5). It looks very much like *A. occidentalis* (Fig.6).

3. Combining the fragment mentioned above with the almost complete cranium allows a tentative reconstruction of a whole specimen. Figures 7 and 8 are mobile superpositions of occipital and superior views of the FLA 236-3770 fragment and the corresponding views of the FAM 113143 cranium ; they can be moved to assess the fittings. No fitting could be found for the profiles because the photos were not taken in similar enough planes.
Using the two specimens (Table 1) the Simpson’s ratio diagram (Fig.9) shows the main characters of the cranium : caballine proportions for the vomer-palate distances (3-4) ; long and narrow muzzle (5-17) ; high forehead (28).
The relative lengths of Anterior and Posterior Ocular lines (Fig.10) are like in *Amerhippus*.
In conclusion the cranium of Cedar Meadow Spring belongs to an *Amerhippus*, whether "*fraternus*", or any other name is given to this species.

4. In her dissertation (1985, p.229) Melissa Winans gave measurements of a third metacarpal (MC) from the Rancholabrean of Itchetucknee. Its proportions are very much alike those of *Amerhippus occidentalis* from Rancho La Brea and of Amerhippus from South America (Fig.11). Thus the MC confirms the attribution of the Cedar Meadow equid to Amerhippus.
Actually, it is surprisisng how stable these proportions seem to remain from the Early Irvingtonian (Gilliland, Arkalon Gravel Pit) to the Holocene (Hornsby Spring). All these MC have developed proximal and distal depths, and distal articular widths ; although there are differences in dimensions, there is no evident trend in increasing or decreasing size (Fig.11).

5. Although much older, a mandibular fragment from Haile VIA referred by Hulbert to *Equus sp*. C (1995, Figure 9, Table 2) seems a good fit for the Cedar Meadow skull. Using Hulbert’s data and photograph I reconstructed the anterior part of the mandible in occlusal view (Fig.12). The incisors have no infundibula - an *Amerhippus* character. The alveolar border is rounded and the symphysis is long enough to match the muzzle of Cedar Meadow skull.

### ****Powers ranch, 75-125 ka ?****

Quinn (1957) described a new species based mainly on remains of a single juvenile individual found in the Berclair terrace deposits on the bank of Blanco Creek, Texas. Referred to *Onager altidens* because of its slender bones and high-crowned teeth, this individual is remarkable by the lack of cups on the lower incisors (Fig.13). The specific name "*altidens*" being preoccupied, Hulbert renamed it "*pseudaltidens*". 
 The upper P2-P4 (Fig.4) have wide para- and mesostyles, plicated fossettes, long plis caballin, and oblique, grooved and long protocones. 
 The lower cheek teeth are not caballoid at all : on P3 and P4 the lingual valley is "V" shaped, the P2 bears a pli protostylid and the M1 has a bilobated metaconid. Apart from the extant E. grevyi, plis protostylid on P2 are very rare ; they may be found in South American *Amerhippus* (Fig.14). Bilobated metaconids are frequent at Cedazo, Mexico and in South American *Amerhippus* ; they are also found in the large *Amerhippus* of Natural Trap. 
 The metapodials (Fig.15) are slender - especially the MC which looks more juvenile than the MT. Quinn (1957, p.20) referred to *Onager fraternus* another MT - from Ingleside pit (or Trinity River Terraces ?) ; I believe it belongs also to the species from Powers ranch. The corresponding Simpson’s diagrams (Fig.16) show that both MT have the same proportions as *Equus sp*. B of Leisey Shell Pit A although they are larger. Like in the MC of *Equus sp. B* from Leisey, the diaphysis and the proximal epiphysis are deep and the distal articular width is wider than the supra-articular one. 
In addition to the slenderness, these characters are found *in E. calobatus* and *E. semiplicatus* whih may point to their belonging also to *Amerhippus* (Fig.16). The data on two specimens from G Quarry were published by Winans (1985, p.231) ; unfortunately I lost my notes and know no more where or what age Quarry G is.

Given the characters noted above, it seems justified to refer to the equid of Powers ranch as *Amerhippus pseudaltidens*.

### **Hay Springs, 300 BP**

The skull UNSM 1349 was referred by Azzaroli to *E. fraternus*. The cranium bearing the number "13" at the AMNH (= FAM 116141 noted by Azzaroli ?) very probably belongs to the same species (Fig.17). Combining both crania and deducing the probable basion-vomer and vomer-palate distances enables to draw a tentative Simpson’s diagram (Fig.18). Apart from the choanal length (at all times difficult to measure and especially on the badly preserved crania) the species of Hay Springs seems similar to *E. semiplicatus* of Channing ; compared to *A. "fraternus"* of Cedar Meadow (Fig.19) the size is smaller and the muzzle is shorter and wider (5-17). It is not as rounded as in the Cedar Meadow specimen (Fig.20) and I do not think it is just because the latter is an old individual. I do not think either that the Hay Springs specimens belong to the species of Cedar Meadow Spring.

The scatter diagrams used to separate *Amerhippus* and Caballines give contradictory evidence : *E. semiplicatus* from Hay Springs and Channing are Caballine-like for Anterio-Posterior lines (Fig.10) but *Amerhippus*-like for palatal proportions (Fig.2) and for depth of narial opening (Fig.3). 
Perfect cups are present at Channing. Since extant African *E. burchelli* may have cups or lack them, and since cups may occasionally occur at least on I1 and I2 in South American *Amerhippus* (Fig.21), perhaps too much store should not be set on this point.

### ****Pool Branch, 460-490 BP****

 The cranium from Pool Branch AMNH 9558 is very different from *A. "fraternus"* of Cedar Meadow (Fig.22) : it has a shorter vomer-palate distance (Fig.23) and is notably smaller (Table 2). The palatal length and the vomer-palate distance do not have *Amerhippus*-like proportions (Fig.24). 
 Cheek teeth (Fig.25)
The upper cheek teeth are plicated, the plis caballin are well developed, the 
parastyle of P3 is slightly grooved. The lower molars are caballoid, the ectoflexid is shallow on M1 and M2, deep on M3, the plis caballinid are present. The closest patterns I found were in specimens from Cedazo (Sangamon, W. Central Mexico Plateau) IGM 56.51-54 and FC 716 illustrated by Mooser,1958-1959. I do not know whether the lower incisors had cups and how completely developed they were. 
The metapodials will be discussed below.

### ****Leisey Shell Pit 1A, 1.07-1.55 My****

The numerous fossils of *Equus* found at Leisey Shell Pit 1A were described by Hulbert (1995) as *Equus sp*. A (most abundant and middle-sized), *Equus sp.* B (small-sized), and *Equus sp*. C (least abundant and largest). Their symphyses are strikingly different (Fig.26). 
Unfortunately cranial (Table 3) and mandibular (Table 4) remains from Leisey are all fragmental and it is difficult to ascertain to which species - *Equus sp*. A, B, or C, they belong. I have tried to figure it out at least for cranial and mandibular muzzles. The used correlation "gymnastic" is detailed in the Appendix. Combining the calculated data on cranial and mandibular muzzle lengths brings some additional information (Fig.27) : 
 The range of variation for *Equus. sp.* A is abnormally large including almost all specimens. 
 There are two cranial specimens (UF 85517 and 85518) plus the maximum for mandibular specimens referred to *Equus sp*. A that are very close to *Equus* *sp*. C.

*****Equus sp*. A**** 
 Muzzles and symphyses from Leisey.
The muzzle of UF 85516 from Leisey is about the same size as Pool Branch (Fig.27).
The muzzle of Pool Branch is rounded. The symphysis UF 83450 (probably the smallest of the Leisey sample) is rounded also (Fig.28). The cups are well developed on I1, less so on I2, and absent in I3. 
 The pattern of the upper cheek teeth of specimen UF 85518 referred to *Equus sp*. A is almost identical to those of *E. niobrarensis* type and of the Rancho La Brea horse 9G 14-10,5 (Fig. 29) ; the latter was found associated to perfectly caballine lower cheek teeth (Fig.30). The upper dentition of Pool Branch and UF 85518 are about the same size but protocones are longer, flater, and grooved in the later (Fig.29, 34). 
 The lower dentitions are very confusing (Fig.30) ; the only one typically caballine is that from Rancho La Brea. 
 The range of variation for 47-56 MC is rather large (Fig.31, Table 5). The mean for MC from Leisey is only slightly different from Pool Branch ; one specimen from Port Charlotte preserved at the Field Museum in Chicago resembles slightly more Leisey MC than Pool Branch ones.The only two MC from Pool Branch are very close to UF 86219 (Fig.32) from Leisey according to the measures I took on that illustration. A MC from the Rancholabrean of Santa Fé is larger but similar in proportions. Two Irvingtonian MC (Inglis, Coleman) also. 
 On MT, the proximal depth measured by Hulbert is articular and in consequence is smaller than the reference one of *E. hemionus onager* on Simpson’s diagrams and much smaller than the maximal one given by Melissa Winans in her 1985 dissertation (Table 6). Again, the range of variation is large. The MT from Pool Branch are slightly slenderer and deeper than those of Leisey Shell Pit A but they may belong to the same species. Measures taken on the photograph of UF 67372 of Leisey (Fig.32) are close to the mean of Pool Branch ; the MT FM 14323 from Port Charlotte probably belongs also to *Equus sp*. A (Fig.33). 
 To conclude, it seems that more than one species is referred to as Equus sp. A. Possibly one of them is a small *E. niobrarensis*.

*****Equus sp*. C**** 
 The largest species has a long symphysis with a rounded alveolar border and no cups at all on the incisors (Fig.26). 
 The only cheek teeeth illustrated by Hulbert are two upper P2 ; they have wide and bifid mesostyles ; the fossettes are plicated and the plis caballin present (Fig.34). Occlusal dimensions of P3-M2 overlap those of *Equus sp*. A and B but the protocones are clearly longer (Fig.35). 
 There are not many data on MC of *Equus sp*. C ; they appear larger but otherwise no different from *Equus sp*. A. Several MC from Arkalon are larger but not too different (Fig.36). 
 The single MT of *Equus sp*. C is the largest and the most robust (Fig.37) ; its supra-articular (10) width is larger than the articular one (11). MT from Arkalon are rather similar.

### *Equus sp*. B

 This species is small, has a wide, quadrate symphysis, with well developed cups on the worn lower incisors. Using the data given by Hulbert as minima for *Equus sp*. B, I made a tentative reconstruction of the occlusal aspect of the mandible (Fig.38). 
 The upper cheek teeth have no plis caballin but deep post-protoconal grooves ; the mesostyles are wide, and slightly grooved at least on P4 and M2 ; the fossettes are plicated. They resemble very much the type series of *E*. *aguascalientes* (Mooser, 1958-1959 ) and another, smaller, species from Cedazo (Fig.39). They are not like the equids from Pool Branch or like *Equus* *sp*. A from Leisey (Fig.34). 
 The lower cheek teeth resemble many specimens from Cedazo, including one lacking infundibula, and also the type of *A. francisci* (Fig.40). 
 The metapodials are slender (Fig.41). As already noted they are smaller but alike *A. pseudaltidens* (Fig.16).

### **Conclusions**

 *Amerhippus fraternus* is represented in the Rancholabrean of Cedar Meadow Spring, Florida, by a cranium and a MC III. The cranium is large (basilar length ca. 570mm), with caballine basilar proportions, and a long, rounded, narrow muzzle. The MC is robust and similar to many *Amerhippus* species in its proportions. The lower dentition is not known. 
 *Amerhippus pseudaltidens* from the Rancholabrean of Powers ranch, Texas, is about the same size and the upper cheek teeth are similar. The symphysis is long, the lower incisors have no cups. The pattern of the lower cheeek teeth resembles that of specimens from Tarija, Bolivia ; Cedazo, Mexico ; and Natural Trap, Wyoming. The MC III is slender and resembles many specimens from *E. calobatus*-*E. semiplicatus* group. 
 The skull from the Irvingtonian of Pool Branch belongs probably to a Caballine ; it differs from both precedent ; the cranium is smaller, with a shorter muzzle ; the basilar proportions are caballine. The cheek teeth resemble some from Cedazo. 
 "*Equus sp*. A" from the Irvingtonian of Leisey Shell Pit A probably includes more than one species, one of which may be a small *E. niobrarensis*. Mean size and proportions of metapodials are close to those of Pool Branch. Cups seem absent only on lower I3. 
 *Equus sp*. B is a small species, with well developed cups on the lower incisors, a rather long muzzle, and a quadrate alveolar border. The upper cheek teeth are slightly smaller than in the type of *E. aguascalientes* from Cedazo but very similar. The metapodials are smaller but otherwise alike to *A.* *pseudaltidens*. The presence of cups is the only character that does not fit with a referral to *Amerhippus* but, as noted above, the lack or presence of cups may not be of paramount importance. 
 *Equus sp*. C is the largest and the less known of the equids from Leisey Shell Pit A.
The symphysis is long, the alveolar border rounded, and the incisors have no cups. The metapodials resemble those from Arkalon. 
 As noted by Leidy and Cope, "*E. fraternus*" (here considered as an *Amerhippus*) is very much "Caballine" by many aspects. It is hard to reconcile these resemblances with a Late Blancan separation between the two lineages.

### ****References****

Azzaroli, A. 1995. - A synopsis of the Quaternary species of *Equus* in North America. Bolletino della Societa Paleontologica Italiana, 34(2), 205-221.

Azzaroli A., 1998. The Genus *Equus* in North America. The Pleistocene species. Palaeontographia Italica, 85 : 1-60, 21 pl.

Cope E. 1892. A contribution to the Vertebrtae paleontology of Texas. Proceedings of the American Philosophical Society, 30, 123-131.

Eisenmann V., Howe J., Pichardo M. 2008 (paru 2011). Old World Hemiones and New World slender species (Mammalia, Equidae). Palaeovertebrata 36(1-4) : 159-233, 73 fig., 4 append. fig., 8 tabl.

Hay O.P. 1913. Notes on some fossil horses with description of four new species. Proceedings of the United States National Museum, 44(1969) : 569-594.

Hulbert R.C. Jr. 1995. - *Equus* from Leisey Shell Pit 1A and other Irvingtonian localities from Florida. Bull. Florida Mus. Nat. Hist. 37(II) : 553-602.

Mooser O., 1958. La fauna "Cedazo" del Pleistoceno en Aguascalientes. An. Del Inst. de Biologia Mexico, 29 : 409-573.

Savage, D. E. (1951) Late Cenozoic Vertebrates of the San Francisco Bay Region. University of California publications, Bulletin of the Department of Geological Sciences 28(10), 215-314.

Winans M.C., 1985. - Revision of North American fossil species of the genus *Equus* (Mammalia : Perissodactyla : Equidae). Dissertation, Univ. of Texas : 264pp., 26 fig., tables, Austin.