LESIONS ON A LUMBAR VERTEBRA OF EQUIDAE (PERISSODACTYLA) FROM LATE PLEISTOCENE OF BRAZIL

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Nota científica/Scientific note

ABSTRACT – We identified two bone alterations: a bone overgrowth on the margin of the anterior vertebral endplate, and an articular defect on the posterior vertebral endplate in a lumbar vertebra of *Hippidion* (attribution based both on size and spatial association with isolated teeth unquestionably from the Late Pleistocene of northeastern Brazil). The alterations are assigned to spondylosis deformans and a linear defect, respectively. Both alterations are formally described for the first time in the fossil record of the South American mammals.

Key words: *Hippidion*, Equidae, spondylosis deformans, linear defect, Late Pleistocene.

INTRODUCTION

Diagnosis of diseases in the fossil record of the family Equidae Gray, 1821 are relatively rare. Few studies have described lesions in these animals, including cases of Diffuse Idiopathic Skeletal Hyperostosis (DISH; Rothschild, 1987), spondyloarthropathy (Rothschild et al., 2001), osteoarthritis (Rothschild & Martin, 2003), and Harris lines (Duckler & Van Valkenburgh, 1998), in Pleistocene specimens of the genus *Equus* Linnaeus, 1758. Recently, Griffin et al. (2016) described a mandibular osteomyelitis in *Equus simplicidens* from the Pliocene of North America. There is also a case of spondyloarthropathy in a single specimen of *Pliohippus* Marsh, 1874 from the Miocene of North America (Rothschild et al., 2001).

The paleopathological record of South American fossil equids is even poorer, being completely unknown so far. This is remarkable, since fossil equids are common faunal elements, especially in the Late Pleistocene, where they are represented by two genera: *Equus*, and *Hippidion* Roth, 1899 (Alberdi & Prado, 1992; Silva et al., 2012, and references therein). Here we present for the first time lesions in *Hippidion*, a taxon that emerged in South America during the late Pliocene (~2.6 Ma) in the course of the Great American Biotic Interchange 1, after the uplift of the Panama Isthmus (GABI 1; Webb, 1991; Woodburne, 2010).

MATERIAL AND METHODS

The specimen D GEO-UFPE 6057 was collected in the Quaternary sediments of a natural tank deposit, i.e. natural depressions formed by physical-chemical weathering in fractures on basement outcrops (Paula-Couto, 1980; Araújo-Júnior & Porpino, 2011; Araújo-Júnior et al., 2015), at the Logradouro farm, Incó site, Fazenda Nova District (8º10’56.58”S; 36º9’56.23”W), Brejo da Madre de Deus Municipality, Pernambuco State, northeastern Brazil (Figure 1). It is hosted in the paleontological collection of the Geology department of Universidade Federal de Pernambuco (UFPE), Brazil. The specimen is an almost complete, isolated lumbar vertebra assigned to *Hippidion* (Equidae, Perissodactyla; Figure 2). Although is not possible to assign directly the lumbar vertebra to the genus *Hippidion*, the specimen was collected in spatial association with isolated lower molars. Derived features of *Hippidion* in these molars include metastyle and metacristid placed set apart (instead of united in a double knot as in *Equus*), and the protoconid and hypoconid are acute labially and not rectilinear as in *Equus* (Alberdi & Prado, 1993).

The natural tank deposit of Fazenda Nova district has been filled by three different sedimentary layers (Alves et al., 2007). D GEO-UFPE 6057, as well as all other specimens known, was recovered from sediments of the third (top) layer. This upper stratum is dated between 45.4 ± 4 ka and 12.7 ± 1 ka (Optically Stimulated Luminescence method), which place the material in the Late Pleistocene (Figure 1).

The specimen was macroscopically analyzed in order to recognize the pathological bone alterations, and compared to other material with no lesions. For the specific diagnosis, we used Rothschild (2015), Rothschild & Martin (2006) and Rothschild et al. (2014).
Figure 1. Location map and stratigraphic column of the natural tank deposit in Fazenda Nova district, Brejo da Madre de Deus Municipality, Pernambuco State, Brazil. Abbreviations: ca, calcrete; dr, decomposed rock; gr, granite; gsc, gray sand-clay; lbm, large bones of mammals; li, lytic instruments; mt, megafauna teeth.
RESULTS

On the anterior vertebral endplate, there is a small and smooth bone overgrowth located marginally, which has been denominated osteophyte (Rothschild & Martin, 2006; Figure 2), while on the posterior vertebral endplate of the DGEO-UFPE 6057 there is a linear and elongated defect, which is obliquely orientated and extends from the superior to the inferior edge of the vertebral centrum (Figure 2). This lesion measures 40 mm in length and 7.7 mm in width.

DIAGNOSIS AND DISCUSSION

Spondylosis Deformans (SD)

The marginal bone overgrowth on the anterior vertebral endplate of DGEO-UFPE 6057 could be misdiagnosed as osteoarthritis, a non-inflammatory and non-erosive type of arthritis presents only in synovial joints (Rothschild, 1982; Rothschild & Woods, 1987). This disease can be adequately diagnosed based on the presence of marginal spur (osteophytes) formation (Ortner, 2003; Rothschild & Martin, 2006). Although vertebral bodies can develop osteophytes, this cannot be considered indicative of osteoarthritis once it is limited to synovial joints (Rothschild & Martin, 2006), with which the vertebral bodies do not articulate. Actually, between adjacent vertebrae of the vertebral column lies an intervertebral disc (a fibrocartilaginous joint).

In fact, the osteophyte on the vertebral body of DGEO-UFPE 6057 is indicative of spondylosis deformans (Morgan et al., 1989; Rothschild, 2015). This condition appears to be a nonspecific aging condition, probably not related to lifestyle, height, weight, body mass, physical activity, or reproductive history (Yoshimura et al., 2000), which increases inevitably with age and is usually asymptomatic (Rothschild, 2015). It also can be originated secondary to congenital vertebral deformities, traumas or discospondylities (Morgan et al., 1989; Le Couteur & Child, 1995).

Figure 2. Lesions on lumbar vertebra (DGEO-UFPE 6057) of *Hippidion*. A, C, lumbar vertebra in cranial view; B, D, lumbar vertebra in caudal view. Scale bars = 20mm.
Although spondylolytic deformans has been found in wild-living animals [e.g. Primates, Carnivora and Arctyodactyla (Fox, 1939); cave bears (Ruffer, 1921)] and humans (Kelley, 1992), it is poorly recognized in the mammalian fossil record. Up to now, there is a single case of SD in ancient canids from Central Europe, assigned imprecisely to Pleistocene wolves or Paleolithic dogs (Germannpré, et al., 2016). Ferigolo (1985) presented an extensive formation of osteophyte (see figs. 5–8 in work mentioned) on the anterior and posterior endplate of a thoracic vertebra of Megatherinae (probably Megatherium americanum), interpreted as a degenerative discopathy. In fact, this alteration represents a spondylolytic deformans. Another description of a vertebral osteophyte (in a large ground sloth Eremotherium laurillardi) was performed by Araújo-Júnior et al. (2013; see fig. 12A, p. 67). In this paper, bone lesions were briefly described, and an accurate diagnosis was not carried out. However, this pathological case shown by Araújo-Júnior et al. (2013) also must be interpreted as spondylolytic deformans. Thus, the case presented here is the first diagnosis of spondylolytic deformans formally performed in the South American mammalian fossils.

Linear defect (LD)

The defect found on the posterior vertebral endplate of DGEO-UFPE 6057, non-hemispherical and elongated endplate defect, is characteristic of linear defect (Rothschild et al., 2014). LD is a condition poorly understood, but it appears to represent a different condition from Schmorl’s nodes (Rothschild et al., 2014), a focal irregular or hemispherical bone defect in vertebral endplates, classically related to herniation of the intervertebral disk (Schmorl & Jughanns, 1971; Pfirrmann & Resnick, 2001). Rothschild & Martin (2006) suspect that it represents, in some cases, a residual of brucellosis, a type of infection caused by any species of the genus *Brucella* (Aufderheide & Rodrigues-Martín, 1998; Ortner, 2003). Nevertheless, the involvement infection of vertebrae by brucellosis is often associated with a typical type of ventral osteophyte, so called “parrot beak” (Mohan et al., 1990), and in a later phase of the disease, the destruction of the endplate is expected (Aufderheide & Rodriguez-Martin, 1998). These features are not present in our material, making unlikely a diagnosis of brucellosis. On the other hand, Kelley (1992) and McFadden & Taylor (1989) have considered it as a type of Schmorl’s node. In fact, LD is a phenomenon with unknown pathogenesis.

Linear defect is a phenomenon unknown in the South American mammal fossil record and, as the spondylolytic deformans (a nonspecific aging phenomenon), and linear defect (an endplate vertebral defect). Both alterations are formally presented for the first time in the mammal fossil record of South America.

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