“Elephant-Equus” Event

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The dispersal of primitive elephantines and monodactyl equids in Eurasia has long been regarded as representative of a substantial turnover in mammal faunas, denoting the spread of open environments linked to the onset of cold and dry conditions in the Northern Hemisphere. During the 1980s, this event was named the “Elephant-*Equus* event” and it was correlated with the Gauss-Matuyama reversal, today corresponding to the Pliocene-Pleistocene transition and the beginning of the Quaternary, dated at ~2.6 Ma. Therefore, the Elephant-*Equus* event became a concept of prominent biochronological and paleoecological significance, especially in western Europe. Yet, uncertainties surrounding the taxonomy and chronology of early “elephant” and “*Equus*”, as well as conceptual differences in adopting (or understanding) the Elephant-*Equus* event as an intercontinental dispersal event or as a stratigraphic datum, engendered ambiguity and debate.

Keywords: biochronology ; bioevent ; dispersal event ; Equus Datum

1. Introduction

The beginning of the Quaternary Period is formally tied to 2.58 Ma, the age of the GSSP for the Gelasian Stage in the Monte San Nicola section in Italy, corresponding to the Gauss-Matuyama paleomagnetic reversal [1][2]. Around 2.7–2.6 Ma, the glacial activity of the Northern Hemisphere increased, and major climatic changes took place, basically resulting in a transition from long-term warm–humid conditions to large amplitude alternations between cool–arid and warm–humid environments [2][3][4][5]. The long-lasting trend of increasing cold and aridity observed during most of the Cenozoic and especially after the Mid-Miocene Climatic Optimum—of which the more humid and warmer conditions of the Early Pliocene were a small countertrend [6]—was now accompanied by oscillations between glacial and interglacial periods and, at a finer scale, by a more marked seasonality [7][8].

The important biotic response to these environmental changes has long been recognized and correlated to a transition from the early Villafranchian to the middle Villafranchian, in terms of mammal biochronology [9][10][11][12]. During the 1960s and the 1970s, the concept of biochronology was coming to age as a crucial approach for relating biological events to the geological time scale [13][14][15][16], alongside efforts aimed at identifying consistent subdivisions in the Villafranchian in western Europe (e.g., [9][10][17][18][19][20][21]).

2. Research on“Elephant-Equus” Event

Lindsay et al. [22] undertook paleomagnetic investigations of two stratigraphic sections in Italy yielding the Triversa (early Villafranchian, MN 16a) and Montopoli (middle Villafranchian, MN 16b) classic faunas. The results allowed the authors to correlate what is now identified as the early Villafranchian to middle Villafranchian transition—and the concurrent appearance of *Equus* Linnaeus, 1758 [23], and *Mammuthus* Brookes, 1828 [24]—with the Gauss-Matuyama reversal (today dated at ~2.6 Ma). To clarify the appearance of *Equus* and *Mammuthus* in Europe, Lindsay et al. [22] already recognized the necessity of more data on the 3.0–2.6 Ma timespan, and they further noted that “Biochronological-palaeomagnetic sequence studies [25] of the Ponto-Caspian Basin show the beginning of the *Archidiskodon* Superzone (equivalent to the appearance of *Mammuthus*, and possibly *Equus*) at the Mammoth event (about 3.1 Myr) in that area” [22] (p. 137). *Archidiskodon* Pohlig, 1888 [26], is a genus to which early European *Mammuthus* have long been referred, although it is seldom adopted as valid today [27]. Basically, the important point here is that while Lindsay et al. [22] stressed the correlation of the faunal datum with the Gauss-Matuyama reversal, there was also room for an earlier chronology.

Azzaroli [28] summarized the available data on—and popularized— the major mammal dispersal events that occurred during the Quaternary of Europe, including the “Elephant-*Equus* event”. Since then, the term (sometimes also referred to as the *Equus*-Elephant event, *Equus*/Elephant turnover, *Mammuthus*-*Equus* event, or similar expressions) has widely been used in the literature (e.g., [8][12][29][30][31][32][33][34][35][36][37][38][39][40][41][42][43][44][45]). It is worth noting that Lindsay et al. [22] and Azzaroli [28] used the term “dispersal events” to refer to short periods of intercontinental dispersals and faunal replacement (basically following the concept elaborated by Repenning [46][47]), epitomized by, but not limited to the taxa after which each event was named. Moreover, these dispersal events were also directly associated and thus intrinsically linked (in their interpretation at least) to salient climatic and environmental changes [29]. In other terms, the Elephant-*Equus* event was envisioned as a period of marked faunal renewal, witnessing the disappearance of a “warm forest assemblage” and the arrival of species of a “more open, parkland or savannah landscape”, most notably, primitive elephantid and monodactyl equid [28] (p. 118). Azzaroli [28] suggested a possible chronological range for the Elephant-*Equus* event between 3.0 and 2.5 Ma, but later Azzaroli et al. [29] favored approximating it at 2.6–2.5 Ma.

In the years following the introduction of the term in the literature, that is, between the 1990s and the early 2000s, further discoveries and reinterpretations of old collections have engendered doubts on the correlation of the Elephant-*Equus* event with the Gauss-Matuyama reversal, and on its synchronicity across Eurasia [48][49][50][51]. On the other hand, growing evidence was piling up testifying to abiotic [3][4][5][7] and the possibly related biotic changes in the environment (e.g., [52][53]). Eventually, in 2009, the Quaternary Period/System was formally ratified, and the base of the Pleistocene Epoch/Series was revised, officially resolving a long-lasting debate [54][55][56]. The agreed Pliocene-Pleistocene boundary, corresponding to the beginning of the Quaternary, was set in correspondence to MIS 103 and the Gauss-Matuyama boundary, hence at ~2.6 Ma. Indirectly, this provision enhanced the importance of the Elephant-*Equus* event, owing to its correlation with the beginning of the Quaternary.

Basically, despite representing an important biochronological concept evoked numerous times, the Elephant-*Equus* event has been, and it is still, invested by different meanings, spanning from it being used in a chronostratigraphic sense for denoting the beginning of the Quaternary [37][57], to considering it “a misleading term depicting a diachronous biochronogical event” [45] (p. 23).

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