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Middle Miocene Rodents from the Tarazona Area (Ebro Basin, Spain)

by

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Abstract

The fossil rodents from three new localities are described. The three new localities Tarazona 2, 3 and 4 are stratigraphically superposed to Tarazona de Aragon locality. Based on the faunal composition, two of the localities have been correlated with MN5 and one with MN 6. A more precise age assignation is proposed for Tarazona as Dd, Tarazona 2 as late Dd or E, Tarazona 3 as E and Tarazona 4 G1.

Keywords: Middle Miocene, MN 6, rodents, Tarazona, Spain

Zusammenfassung

Im vorliegenden Artikel werden die Nagetiere aus drei neuen Fundstellen beschrieben. Diese neuen Fundstellen, Tarazona 2, 3, und 4 liegen überhalb der Fundstelle Tarazona de Aragon. Zwei der beschriebenen Fundstellen werden aufgrund der Faunenzusammensetzung mit der MN5-Säugetierzone korreliert, die dritte mit MN6. Eine genauere Alterseinstufung als Biozone Dd wird für Tarazona vorgeschlagen, für Tarazona 2 spätes Dd oder E, für Tarazona 3 E und schließlich Biozone G1 für Tarazona 4.

1. Introduction

The classical vertebrate locality of Tarazona de Aragón (Middle Miocene, Middle Aragonian) is situated in the Ebro Depression, (Geological Map of Spain, 1:50.000 number 320). More precise geographical and geological information can be consulted in Astibia et al. (1981, 1984). Its mammalian fauna has been studied by Astibia et al. (1981, 1984, 1998), Astibia (1985, 1987), Astibia & Morales (1987), Astibia & Mazo (1988), Valdés et al. (1986). Cuenca Bescós et al. (1992) cited the faunal list of this locality in their synthesis article of the Tertiary Ebro Basin. And finally, Pérez (1989) and Pérez et al. (1988a, 1988b, 1989) studied the stratigraphy and the sedimentology of the Iberian Margin of the Ebro Basin, where this vertebrate locality is situated. These authors included it in their Tectosedimentary Unit N1 (U.T.S N1).

During the summers of 1999 and 2000 new field campaigns have been carried out in the Tarazona area. This region is poorly studied in comparison with other Aragon basins like Calatayud-Daroca or Teruel. In order to have more information about Miocene microvertebrate fossils from this area, we prospected for new fossiliferous beds in stratigraphic superposition. Three new fossiliferous beds containing microvertebrate remains were found in higher stratigraphical position respect to the classical Tarazona locality, and along the main sheep track going south. They have been called, from lowest to highest, Tarazona 2, 3 and 4 (abbreviated from here on as TAR2, 3 and 4). All this new localities are integrated in an alternating limestone-marl sequence on top of which there is a new sequence consisting of yellow to brown sandy beds.

Tarazona 2 (TAR2): It is a silty-clay bed, 20 cm thick, situated about 10 m above the classical Tarazona locality. From top to bottom the colour of this bed goes from dark to light grey. It shows remains of gastropods, clay pebbles and scarce bones fragments. Above the fossiliferous bed there is very fine carbonate level and on top of the latter there is a brownish marl bed with nodules of carbonate, gastropods and clay pebbles.

Tarazona 3 (TAR3): It is situated 25 m above TAR2. It is a bed of 7-10 cm thickness of dark marls with vertebrate and carbonaceous remains. Above the fossiliferous bed there is a brownish marl level of 20 cm thickness.

Tarazona 4 (TAR4): It is situated 30 m above TAR3. The thickness of the bed is 30 cm. Its lithology consists of grey marls with numerous carbonaceous remains and

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gastropods. It represents one of the upper levels of the limestone-marl sequence.
Some 150 kg of sediment from each level were screened. The teeth were measured using a Nikon monocular digital measuring microscope, measurements are given in mm. The nomenclature of the check teeth is for the Cricetidae after FREUDENTHAL et al. (1994), for the Sciuridae after CUENCA BESCÓS (1988), and for the Gliridae after DAAMS (1981). The specimens are stored at the Museum of Palaeontology of Zaragoza.

2. Systematic palaeontology

In the following section a short description of the available material of each taxon from each locality will be included.

Ordo: Rodentia BOWDICH, 1821
Familia: Cricetidae FISCHER VON WALDHEIM, 1817

Democricetodon FAHLBUSCH, 1964

***Democricetodon larteti* (SCHAUB, 1925)**
(Plate 1, figs. 1-3)

Material:
Tarazona 2: 2 M1 (2.26 x 1.43), 3 M2 (1.65 x 1.42; 1.51 x -), 4 M3 (1.1 x 1.13; 1.14 x 1.29), 1 m1, 1 m2 (- x 1,41) and 2 m3 (- x 1, 26).
Tarazona 3: 2 M2 (1.80 x 1.56), 1 M3 (1.20 x 1.36), 1 m1, 1 m2 (1. 83 x 1.52) 1 m3 (- x 1.36).
Tarazona 4: 2 M1 (2.19 x 1.34), 1 M2 (1.63 x 1.47), 2 m1 (1.78 x 1.22; 1.94 x 1.29), 2 m3 (1.51 x 1.20; - x 1.27)
Description:
Tarazona 2: Upper molars: The two M1 specimens show a simple morphology with single anterocone, mesoloph short and metaloph and protoloph backwards directed. The posteroloph is almost absent in both specimens. The M2 have also small mesolophs in all three specimens. The protoloph and metaloph connections are double being the posterior the stronger. The M3 have a reduced posterior part, with metacone and hypocone completely integrated on the crest. Sinus closed by a crest connecting protocone and hypocone. The posteroloph joins the metaloph labially.
Lower molars: there are only fragments with a very bad preservation and thus a detailed description is not possible. The m2 fragments show mesolophids of medium length.
Tarazona 3: Upper molars: There are only two complete specimens, one M2 and one M3. In the M2 the protoloph and metaloph are backwards connected. The mesoloph is absent and the posteroloph is small and connected labially with the metacone delimiting a circular basin. The M3 shows a very-reduced posterior part, although the metaloph is still present.
Lower molars: one m1 fragment shows single anteroconid pretty compressed antero-posteriorly. A complete m2 shows a short lingual anterolophid, a very short mesolophid. The sinousid is directed backwards. The remaining material consists of fragments with a very bad preservation not allowing a detailed description.
Tarazona 4: The general aspect of this material is robust and somewhat hypsodont.
Upper molars: There are two very corroded and broken M1 on which the protoloph and metaloph are posterior directed. The mesoloph is absent and the posteroloph is small but present. The M2 shows a paracone almost isolated from the protocone. There is a tiny posterior protoloph. The metaloph is posterior and the posteroloph is very reduced. The mesoloph is absent.
Lower molars: In both m1 collected the anteroconid is single, the lingual anterolophid is absent as is the mesolophid. The m3 shows a lingual anterolophid very short or absent. The posterolophid is also reduced.
Discussion: The material is poor to make precise interpretations and comparisons. Nevertheless, in general seems that there is a small increase in size in this taxon as was demonstrated by VAN DER MEULEN et al. (2003). The classical Tarazona locality has *D. koenigswaldi* with a somehow more primitive pattern (VALDÉS et al., 1986). Both *koenigswaldi* and *larteti* belong to the lineage *D. franconicus – D. crusafonti* defined by VAN DER MEULEN et al. (2003), therefore all this material could be interpreted as different evolutionary stages of the same lineage.

***Democricetodon gaillardi* (SCHAUB, 1925)**
(Plate 1, figs. 4-6)

Material: Tarazona 4: 2 M1 (- x 1.34; 2.10 x 1.41), 1 M3 (1.39 x 1.40), 3 m1 (1.72 x 1.26).
Description:
Tarazona 4: Molars show a high degree of morphological complexity.
Upper molars: There are two M1 showing both a labial spur of the anterolophule that reaches the labial border. The anterocone was probably double in both specimens although the degree of wear does not allow a precise interpretation. The mesoloph is long in both specimens. The metaloph is double-posterior in one specimen and posterior in the other. Paracone and mesoloph are connected labially. The M3 shows a low mesoloph. The metaloph is well developed. In general, the posterior part of the tooth is not very reduced.
Lower molars: In the m1 the anteroconid is single having a lingual position; it is connected to the metaconid lingually. The mesolophid is long and there is a long ectomesolophid that reaches the labial side of the tooth.
Discussion: The material from Tarazona 4 shows similar size and morphology to the type material of *Democricetodon gaillardi* (SCHAUB, 1925) from Sansan described by BAUDELOT (1972) and *D. freisingensis* FAHLBUSCH, 1964 from Giggenhausen and Anwil (FAHLBUSH, 1964; ENGESSER 1972). According to ENGESSER (1972) the only difference between *D. gaillardi* and *D. freisingensis* is the presence of a long labial spur on the anterolophule in the latter. In our opinion this character is not enough to establish a

specific differentiation, since this character is probably dependant on the environment where the populations were living as has been shown by HOOPER (1957) for modern populations of different *Peromyscus* species. Till a more detailed revision of all the material assigned to this to taxa is fulfilled we prefer to consider *D. freisingensis* as a junior synonym of *D. gaillardi*. *Democricetodon gaillardi* has been recorded in Spain from MN 6 localities, such as Las Planas 5B and Las Planas 5 K (FREUDENTHAL & DAAMS, 1988).

Megacricetodon FAHLBUSCH, 1964

Megacricetodon collongensis (MEIN, 1958)

(Plate 1, figs. 8, 9)

Material: see Table 1.

Description:

Tarazona 2: Upper molars: The two specimens collected are M2. They show the protoloph connected transversally. The mesoloph is long in one and medium in the other. The metaloph is anterior or double.

Lower molars: There are three m1, the anterolophid is simple in one specimen while seems to be double in the other two, although it is broken in both specimens. The mesolophid is short in all three specimens. The m2 have a very short lingual anterolophid. The sinusoid is backwards.

Tarazona 3: Upper molars: The M1 shows a double anterocone. Protoloph and metaloph are connected posteriorly. The mesoloph is medium in all specimens.

The connection of the protoloph in the M2 is anterior in two, transverse in one, double anterior in three and double-posterior in one. The metaloph is anterior in three, transverse in three, double-anterior in one, and posterior in one. The mesoloph is long in four, medium in three and short in two. A more or less developed paracone spur is present in all specimens.

Lower molars: m1 with single anteroconid. Mesolophid is absent in one specimen, short in two and medium in one. The lingual anterolophid of the m2 is well developed in two specimens, while it is rather small in the other four specimens. The mesolophid is short in all specimens. The m3 are long and narrow and the lingual anterolophid is very small.

Megacricetodon gersii AGUILAR, 1980

(Plate 1, fig. 7)

Material: Tarazona 4: 3 M1 (1.73 x 1.05; - x 1.08), 1 M2 (1.17 x 1.04), 1 M3, 6 m1 (1.56 x 0.90; 1. 57 x 0.96; - x 0.97; - x 1.01), 4 m2 (1.20 x 0.97; 1.24 x 1.03; 1.29 x 0.99; - x 1.08) and 3 m3 (1.02 x 0.82; 1.09 x 0.90; 1.09 x0.86).

Description:

Tarazona 4: Upper molars: The only complete M1 recorded has double anterocone with the lingual being much smaller than the labial. Protoloph and metaloph are posterior. The mesoloph as well as the posteroloph is medium. The only M2 present shows a double protoloph. There is a posterior spur in the paracone that reaches the labial end of the mesoloph, which is of medium length. The metaloph is transverse, but connects with the anterior arm of the hypocone.

Lower molars: The m1 have an anteroconid lightly split in three out of four specimens, the lingual anterolophid is absent in all specimens. The mesolophid is short in three and absent in the other three. The m2 shows a very small lingual anterolophid and the mesolophid is short in all four specimens. A small lingual anterolophid is also present in the m3, the metaconid and the entoconid are connected by a lingual cingulum.

Megacricetodon minor (LARTET, 1851)

(Plate 1, fig. 10)

Material: Tarazona 4: 2 M1 (1.35 x 0.82), 2 M2 (0.97 x 0.81; 1.02 x 0.82), 1 m1, 2 m2 (1.03 x 0.76; 1.01 x 0.79).

Tarazona 4: Upper molars: M1 with double anterocone, with cones of similar development. Protoloph and metaloph are posterior. The mesoloph is medium and the posteroloph is long delimiting a well-developed posterior sinus; the sinus is transverse and is closed lingually by a low cingulum. There is only one M2 on which the morphology can be studied. Proto- and metaloph are forwards directed. There is a small paracone spur, the mesoloph is medium and the sinus is transverse and is closed lingually by a low cingulum.

Lower molars: There are only two m2 on which the lingual anterolophid is very reduced. The mesolophid is long.

Discussion on *Megacricetodon*: Three species of *Megacricetodon* have been record in the section. *Megacriceto-*

		length					width			
		Min.	Mean	Max.	s.d.	N	Min.	Mean	Max.	s.d.
TAR 2	M2	—	1.10	—	—	1	—	0.91	—	—
	m1	—	1.43	—	—	1/2	0.86	—	0.87	—
	m2	0.95	—	1.14	—	2	—	0.91	—	—
TAR 3	M1	—	1.63	—	—	1/2	1.00	—	1.14	—
	M2	1.04	1.10	1.15	0.038	7/9	0.89	0.99	1.05	0.050
	m1	1.35	—	1.41	—	2/3	0.82	0.86	0.89	—
	m2	1.10	1.16	1.23	0.044	6/7	0.94	0.97	1.00	0.025
	m3	1.02	—	1.04	—	2	0.82	—	0.84	—

Table 1: Summary statistics of *Megacricetodon collongensis* from Tarazona 2 and Tarazona 3.

don collongensis from the lower levels, Tarazona, Tarazona 2 and Tarazona 3 shows the general morphology and size that the material from the middle Aragonian Spanish localities described by DAAMS & FREUDENTHAL (1988). In the same paper, these authors discussed the taxonomic status of the material from biozones F and G1 (MN 6) proposing to call this material as *M. collongensis-crusafonti* indicating that is a recognizable intermediate evolutionary stage between *M. collongensis* and *M. crusafonti*. They, nevertheless, also indicate the close similarities among this Spanish material and the *M. gersii* from Sansan. After the new sampling in the Aragonian type area much more *Megacricetodon* material is available and therefore a more detailed comparison among samples is possible. As a result of the systematic work in progress the taxonomic status of the material from biozones F and G1 in the Calatayud-Daroca basin is now assigned to *M. gersii* as indicated already in DAAMS et al. (1998; 1999). The material from Tarazona 4 agrees morphologically with the material from Sansan and localities from Biozone F and G1, such as Valalto 2C and Las Planas 5B (DAAMS & FREUDENTHAL, 1988). The presence of another *Megacricetodon* species of small size, like *M. minor* supports the correlation of this fauna to the MN 6.

Cricetidae indet.

Material: Tarazona 3: The only specimen, m2 (1.40 x 1.18), recovered is strongly worn. It has a small mesolophid and the sinusid is transverse.
Discussion: The scarcity of the material does not allow a more precise determination. The general morphology fits with that of *Megacricetodon*. The size, however, is rather large, larger than any other *Megacricetodon* described in the Iberian Peninsula. The size and morphology is compatible with *M. germanicus* but, since it will represent the first record of this taxon in Spain, we prefer to leave it in open nomenclature till more material could corroborate or refuse this determination.

Familia: Gliridae MUIRHEAD, 1819

Pseudodryomys DE BRUIJN, 1966

***Pseudodryomys rex* (GARCÍA MORENO 1986) in ÁLVAREZ SIERRA & GARCÍA MORENO, 1986**
(Plate 1, fig. 14)

Material:
Tarazona 2: 1 M2.
Tarazona 3: 1 D4 (1.21 x 1.35), 1 P4 (1.06 x 1.40), 1 m2 (1.61 x 1.65) and 1 m3 (1.36 x 1.38)
Tarazona 2: The only specimen is a fragment of an M2. There are two centrolophs, the anterior being longer than the posterior and connected labially to the protoloph, while the posterior is unconnected labially. There are another three extra crests inside the trigone. The one between the protoloph and the anterior centroloph is long and is connected lingually to the latter.
Description:
Tarazona 3: Upper molars: Only a D4 and a P4 are represented. Both specimens have two centrolophs. In the P4 the centrolophs are of similar length and are connected lingually. In this specimen the metaloph does not reach the labial side and almost connects with the labial end of the posteroloph. The D4 shows a posterior centroloph that is longer than the anterior. There is also an extra crest between the two centrolophs.
Lower molars: The only m2 present has nine crests. Anterior and posterior to the long centrolophid there is two small extra ridges. The bad preservation of this specimen does not allows a more detailed description. The other specimen present is an m3. It has ten ridges, two of which are very small (see plate I, fig. 14). The metalophid does not reach the lingual part and it is almost connected with the long anterior extra ridge.

Microdyromys DE BRUIJN, 1966

***Microdyromys complicatus* DE BRUIJN, 1966**
(Plate 1, figs. 12, 13)

Material: Tarazona 3: 1 P4 (0.97 x 1.07), 1 M1 (1.00 x 1.06), 3 M2 (0.97 x 1.13; 0.97 x 0.99; 1.05 x 1.13), 1 m1 (1.02 x 0.90), 1 m2 (1.01 x 0.94)
Description:
Tarazona 3: Upper molars: All M1-2 have a complete endoloph. Both centrolophs are long, almost reaching the endoloph, and in three specimens the two are connected lingually. All specimens have an extra ridge in the anterior valley, the posterior valley, and between the anterior centroloph and the protoloph. Only in two specimens there is a short extra ridge between posterior centroloph and metaloph. The P4 has rounded outline. The anteroloph does not connect with the endoloph. The anterior centroloph is long and there is an extra ridge small in the anterior valley.
Lower molars: There are two specimens: 1 m1 and 1 m2. The m1, despite being very worn, shows nine ridges. One of the extra ridges in the anterior valley, the one in the posterior valley, and the centrolophid are long. The m2 has eleven ridges; three of them are in the posterior valley, two at both sides of the long centrolophid, and another in the anterior valley. The centrolophid and the posterolophid are connected with the mesolophid labially.

***Microdyromys monspeliensis* AGUILAR, 1977**
(Plate 1, fig. 15)

Material:
Tarazona 3: 1M2 (0.98 x 1.17)
Tarazona 4: 1 M1 (1.06 x 1.27), 1 m1 (1.12 x 1.01), 1 m2 (0.97 x 1.00)
Description:
Tarazona 3: There is a single specimen, M2, showing a complete endoloph. It shows an anterior centroloph of medium length. The posterior centroloph is very short and less- developed than the anterior. There is also a very

small extra ridge between the protoloph and the anterior centroloph.
Tarazona 4: Upper molars: Only a M1 is represented. The posterior and labial part are broken. The anteroloph is almost disconnected from the endoloph lingually. There are an anterior centroloph of medium length and a small posterior one.
Lower molars: There are two specimens: 1 m1 and 1 m2. The two specimens have seven ridges. In both specimens the centrolophid is of medium length and the extra ridges are small, especially the one in the anterior valley. In the m2 the metalophid does not reach the lingual border. There is a longitudinal connection between the anterior extra ridge and the centrolophid.

Armantomys DE BRUIJN, 1966

***Armantomys* sp.**

Tarazona 2: The only specimen is pretty damaged. It represents an M3 with four parallel crests that are progressively shorter going backwards.

Muscardinus KAUP, 1829

***Muscardinus* sp.**

Tarazona 3: There are two specimens. The lower p4 shows a simple morphology. It has a very small extra ridge in the lingual part of the posterior valley. The other specimen is a broken upper M1-2. The general morphology is quite complicated with numerous extra ridges starting from the labial side.

Familia: Sciuridae FISCHER VON WALDHEIM, 1817

Heteroxerus STEHLIN & SCHAUB, 1951

***Heteroxerus* cf. *rubricati* CRUSAFONT, DE VILLALTA & TRUYOLS, 1955**

Tarazona 2: The only material available is an m1. It is very corroded, therefore its morphology cannot be described with precision. The specific determination is based mainly in its small size.

***Heteroxerus grivensis* FORSYTH MAJOR, 1893**
(Plate 1, figs. 17, 18)

Material:
Tarazona 3: 1 D4, 2 P4 (1.55 x 1.99), 4 M1-2 (1.75 x 1.92), 1 p4, 1 m1-2, and 2 m3 (1.79 x 1.74; - x 1.93)
Tarazona 4: 1 D4 (1.63x 1.66), 2 M1-2 (1.84 x 2.32; 1.69 x 2.07), 1 p4 and 1 m1-2
Description:
Tarazona 3: Upper molars: The material is in general broken and poorly preserved. Nevertheless, some characters could be observed. The P4 shows a robust pattern. The protoconule is still distinguishable. The hypocone is small and the metalophule is connected to a short posteroloph. The M1-2 shows a paraconule of variable development, from absent to well developed.
Lower molars: The p4 shows the four main cusps well developed. The m3 has a well-developed anterior cingulum. The anteroconid and the entoconid are small.
Tarazona 4: Upper molars: The D4 has a well-developed anterior lobe. The metaloph is isolated. The hypocone is well developed but smaller than the protocone. The two M1-2 show a well-developed hypocone. The metaconule is also large and is connected to the posteroloph.
Lower molars: The d4 shows a small anteroconid. The metalophid and entolophid are transverse. There is a small hypoconulid in the posteroloph.. There are only two very bad preserved m1-2. A small anterior cingulum is present in both. The anteroconid is well developed in one specimen and it is connected to the metaconid and protoconid.

Spermophilinus DE BRUIJN & MEIN, 1968

***Spermophilinus bredai* (VON MEYER, 1848)**
(Plate 1, fig. 16)

Material:
Tarazona 3: 1 M1-2 (1.74 x 1.96)
Tarazona 4: 1 M1-2, 1 m3 (2.23 x –)
Description:
Tarazona 3: The only specimen, an M1-2, shows a very characteristic morphology. The anteroloph is lower than the other lophs. The narrower part of the metaloph closes its connection to the protocone. A mesostyle is present.
Tarazona 4: The posterior part of the M1-2 is broken, but a thin connection between metaloph and protocone can be observed. The m3 is relatively large. The anterior cingulum is absent. There is a mesoconid in the ectolophid. The entoconid is very small.

3. Biochronological considerations

Table 2 shows the faunal list of the Tarazona de Aragon classic locality and the three new faunas included in this paper. According to VALDÉS et al. (1986) Tarazona can be correlated to biozone D of DAAMS & FREUDENTHAL (1981) from the Calatayud-Daroca basin. A more refined biostratigraphy has been published since then (DAAMS et al., 1998, 1999) and therefore the comparison of this fauna with the rich record from the Calatayud-Daroca basin enables a more precise biochronological correlation. The assemblage from Tarazona shows the combination of a rather large *Democricetodon koenigswaldi* and *Fahlbuschia* sp. According to the recent work of VAN DER MEULEN et al. (2003) the material assigned to *Fahlbuschia* sp. can be assigned with certitude to the lineage *D. hispanicus-D. lacombai*. Although the material is scarce, the size of the specimens are compatible with a large *D. jordensi* or an early *D. lacombai*, so it is difficult to propose a more precise determination with the available material. According to these comparisons we can precise that the fauna from

Tarazona can be correlated with the zone Dd of DAAMS et al. (1999). Tarazona 2 and 3 show a very similar taxonomic assemblage. The lower boundary for the age of those localities is defined by the Tarazona locality as Dd. The presence in both localities of *M. collongensis* establishes the upper limit to the zone E (upper MN 5), since this taxon has been never recorded higher than this biozone (DAAMS et al., 1998, 1999). The *Democricetodon* material from these two localities is assigned to *D. larteti*. According to VAN DER MEULEN et al. (2003) this taxon shows a distribution in the Aragonian type area from upper Dd till G3 (MN 7/8). The material from Tarazona 2 and 3 is not enough for a precise determination of their evolutionary stage or to make a direct comparison with the available material from the Calatayud-Daroca area. It is important, however, to point out the absence of representatives of the second *Democricetodon* lineage (*D. hispanicus – D. lacombai*). Generally, specimens assigned to this lineage are present in Dd localities, while they are rare or even absent in E localities in the Spanish central basins, such as Madrid and Calatayud-Daroca. Therefore, the proposed correlation for Tarazona 3 is with zone E. Tarazona 2 has less material and therefore is more difficult to use an absence argument to support this correlation and thus we prefer to be more cautious and correlate it with the late Dd or E. The other taxa recorded in the assemblage are fully compatible with these correlations. The recorded glirids in Tarazona 3, *Microdyromys complicatus*, *M. monspeliensis*, *Pseudodyromys rex* and *Muscardinus* are taxa that are more frequent in localities from zone E. In addition *H. grivensis* is also the dominant *Heteroxerus* species during zone E in the Spanish basins, which reinforces the proposed correlations.

Tarazona 4 shows a different rodent assemblage with *M. gersii* and *M. minor* as a typical combination taxa defining zone G1 (MN 6) of DAAMS et al. (1999). The other taxa present in this assemblage, such as *D. gaillardi*, are also recorded in this period in other European localities from MN 6 and MN 7/8.

Taxon	Tarazona	Tarazona 2	Tarazona 3	Tarazona 4
Democricetodon sp.	X			
D. koenigswaldi	X			
D. larteti		X	X	X
D. gaillardi				X
Megacricetodon collongensis	X	X	X	
M. gersii				X
M. minor				X
Cricetidae indet			X	
Pseudodryomys ibericus	X			
Microdyromys koenigswaldi	X			
M. monspeliensis			X	X
M complicatus			X	
Pseudodryomys rex		X	X	
Armantomys sp.		X		
A. aragonensis	X			
Muscardinus sp.			X	
Heteroxerus sp.	X			
H. rubricati	X	cf.		
H. grivensis			X	X
Spermophilinus bredai			X	X

Table 2: Faunal lists from the Tarazona localities. The list from Tarazona is modified after VALDÉS et al. (1986)

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PLATE 1

***Democricetodon larteti* (SCHAUB, 1925)**

Fig. 1 TAR3- 37, left m2

Fig. 2 TAR4- 1, left m1

Fig. 3 TAR4- 14, left, m3

***Democricetodon gaillardi* (SCHAUB, 1925)**

Fig. 4 TAR4- 9, right M1

Fig. 5 TAR4-11, right m1

Fig. 6 TAR4- 7, left M3

***Megacricetodon gersii* AGUILAR, 1980**

Fig. 7 TAR4- 33, right M1

***Megacricetodon collongensis* (MEIN, 1958)**

Fig. 8 TAR3 -58, left M1

Fig. 9 TAR3- 57, right m1

***Megacricetodon minor* (LARTET, 1851)**

Fig. 10 TAR4- 31, left M1

Cricetidae indet.

Fig. 11 TAR3- 32, right m2

***Microdyromys complicatus* DE BRUIJN, 1966**

Fig. 12 TAR3 -18, right m1

Fig. 13 TAR3- 21, left M2

***Pseudodryomys rex* (GARCÍA MORENO, 1986)**

Fig. 14 TAR3- 24, left m3

***Microdyromys monspeliensis* AGUILAR, 1977**

Fig. 15 TAR3- 27, left M2

***Spermophilinus bredai* (VON MEYER, 1848)**

Fig. 16 TAR3- 1, right M1-2

***Heteroxerus grivensis* FORSYTH MAJOR, 1893**

Fig. 17 TAR4- 47, left M1-2

Fig. 18 TAR4- 46, right M1-2

PLATE 1