The Cretaceous/Paleogene (K/Pg) Working Group, after many years of studies, voted to define the Global Stratotype Section and Point (GSSP) for the base of the Cretaceous/Tertiary (K/T) boundary at a section near El Kef, Tunisia. The GSSP was approved by the International Commission on Stratigraphy (ICS) and ratified by the International Union of Geological Sciences (IUGS) in 1991. Nevertheless, the GSSP was not officially published, although some papers dealing with geological aspects of the K/Pg boundary at El Kef have been published and this is quite well known. In April 2006, the GSSP was revisited, a marker was put in place and protection of the site was requested. Many correlation criteria are present at the GSSP of which the most useful are the meteorite impact evidence (iridium anomaly, Ni-rich spinel, etc.) and the mass extinction of planktic micro- and nanofossils. This event coincides with the GSSP, allowing us to propose that the K/Pg boundary is marked exactly by the moment of the meteorite impact, which implies that all the sediments generated by the impact belong to the Cretaceous. This definition solves problems of correlation in the Yucatan peninsula (Mexico) and its surroundings.

Introduction

The Cretaceous/Paleogene (K/Pg) boundary marks the base of the Cretaceous/Tertiary (K/T) boundary, but the term “Tertiary” has become informal and is not used in the Geologic Time Scale edited by Gradstein et al. (2004). This important boundary was discussed extensively at the International Geological Congress in 1960 in Copenhagen and attracted increased attention of the scientific community since Lerbcharber and Premoli Silva (1964) defined the Globorita exsul catastrope in the Central Aquitaine and it was calibrated to magnetostriatigraphy by Alvarez et al. (1977). It has been studied even more intensively since Alvarez et al. (1980) found the Ir anomaly at Gubbio (Italy) and Smit and Herregen (1980) at Cavaooa (Spain). Nevertheless, the boundary needed a precise definition, as some geologists continued to include the Danian in the Cretaceous. An International Working Group, chaired by Katharina von Stacke-Nielsen, was established under the auspices of the International Commission on Stratigraphy (ICS) to formally define a GSSP for the K/Pg boundary.

The first step was achieved in 1982 when all but one of the members of the Working Group voted in favour of placing the K/Pg boundary between the Maastrichtian and the Danian, thus ending the old tradition of including the Danian in the Cretaceous. Several sections were studied for consideration to site the GSSP and after narrowing down the choice of localities to four in 1988, a postal ballot resulted in the following distribution of votes: 10 for El Kef (Tunisia), 6 for Zumaia (Spain), 2 for Braza (USA) and 2 for Stevns Klint (Denmark). A final postal ballot in 1989 gave the following result: 26 in favour of El Kef, 8 against, 1 abstention and 4 members gave no reply. For the exact point, at which the GSSP should be defined, the result was the following: 11 for the base of the Boundary Clay, 3 for the first occurrence of D menua california (diatom) 3 for the Iridium maximum, 1 for the base of the tsunamiite and 1 for another. Consequently, the chairwoman, von Stacke-Nielsen, on behalf of the K/Pg Boundary Working Group submitted a written proposal to the ICS defining the GSSP of the K/Pg boundary at the base of the boundary clay at the section near El Kef, Tunisia. This proposal was approved by the ICS in 1990 after obtaining an 80% majority and was ratified by the International Union of Geological Sciences in 1991.

The final step in the definition of a GSSP is its publication in a prestigious stratigraphical journal with wide distribution. The chairwoman promised to shorten the original proposal in order to make it an article for Episodes. However this final step has not yet been made. Only a short note was published in Episodes by Cowie et al. (1989), in a report on activities of the ICS from 1984 to 1989. Since then, certain problems have arisen as the detailed proposal was unknown to many scientists working on the K/Pg boundary. New sections were found in Mexico and controversial interpretations were proposed. Therefore, in order to resolve these problems, the ICS has requested the International Subcommission on Paleogene Stratigraphy (USPS) to finally publish the proposal. The chairman of
ISPS (E.M.) in cooperation with Tunisian colleagues again visited the GSSP at El Kef, in order to place an artificial marker ("golden spike"), and to request the Tunisian authorities to protect the site. At the same time, the present status of the site has been documented by a series of photographs. The aim of this paper is to publish an abbrevi- ated original proposal to review the studies since the original pro- posal and to revise the main criteria defining the K/Pg boundary.

The abbreviated original proposal

The approved and ratified proposal of the GSSP consists of 8 pages of text and more than 400 pages with photographs of the site and fig- ures and tables mainly taken from publications. It contains many details and many of the figures need revision after over 15 more years of research in Tunisia and around the world. Consequently, the origi- nal proposal that follows is a shortened version, maintaining most of the text and eliminating the figures that can be found in the cited papers older than ca. 1989.

Geographical location and geology

The location of the El Kef section was indicated in three figures after Lindinger (1988), showing a general map of Tunisia, a map of the El Kef area and a detailed map of the section (Figure 1). The GSSP site is located at a distance of between 5 and 6 km from the crest of the line of the El Kef city. It can be reached by taking the exit towards the town of Tadenzine and following the road which leads to Hammam Melloug. The GSSP section is located 3 km from the road sign to Hammam Melloug between a small village and a recent artificial lake. The GSSP was indicated on a topographic map of the area, but the precise coordinates were not given. In addition, two photo- graphs were also included plus an overview of the access to the pro- posed GSSP locality and an overview of the proposed GSSP locality.

The GSSP lies in the upper Maastrichtian to Paleocene El Haria Formation, which is underlain by the upper Campanian/Lower Maastrichtian Aouina Formation and overlies by the lower and middle Eocene Bon Dabbous/El Garia Formation (attributed to the Metacrat Formation in the original proposal).

The lithology of the boundary interval can be subdivided into 5 units:

A: white-grey marls in the uppermost 4.5 m of the Maastrichtian. These have an average CaCO₃ content of 40%. The uppermost Maastrichtian contains burrows of darker Jurassic sediments. These burrows furnished the extremely negative δ¹³C value of -4.93 and are also enriched in Ir, Os and Au (Petch-Nielsen et al., 1982).

B: 0.5 m black clay = Boundary Clay with an average CaCO₃ con- tent of 5%. At its base, a 1-3 mm thick rust-colored ferruginous layer marks the boundary event (s). This layer is composed of reddish hematitic and goethitic laminae (Lindinger, 1988). According to the same author, it contains less than 1% CaCO₃, and a maximum in TOC (Total Organic Carbon), Kudriavtsev and Kritkow (1983) found enrichments in Ir and Os in the dark layers. It is very rich in Pa, Xe, Yb and Lu. The maximum Ir content of 16.25 ppb is restricted to the rusty layer of the basal Boundary Clay.

C: 0.5 m dark grey clay with slightly higher CaCO₃ content (6-10%).

D: 4.1 m grey, clay-rich shale with an average CaCO₃ content of 4%.

E: > 10 m white-grey clayey marls, with an increasing CaCO₃ con- tent of 20-25% between 2.5 m and 3.0 m above the boundary.

Details of the boundary section

The proposed GSSP is at the base of the Boundary Clay. At El Kef, this base is characterised by a rust-coloured layer. It is this layer which in many K/Pg boundary sections includes geochemical anomalies, spherules, shocked quartz, and is considered to be isochronous all over the world, in marie as well as in continental sections.

Figure 1 Geographical and geological location of the El Kef section. Modified from Lindinger (1988).

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Reasons for the choice of the GSSP

The El Kef is a thick section including the sequence of events across the boundary. The section contains well-preserved faunas also shown from many other sections in the world, including continental ones, and can thus be easily correlated to El Kef: Boundary Clay, Ir anomaly, TOC maximum, stable isotope shift, decrease of CaCO3 content. Also, calcareous microfauna and microfossils as well as dinoflagellates are common and well preserved above and below the boundary and allow wide correlation. The choice of the geographic location was based on the quality of the section.

Method of marking the GSSP: The marker ("golden spike") is placed where the hill is relatively steep so that it is in an area of cleaner, fresher sediment. An iron rod will be put inserted into the cliff at the appropriate level and the site will be protected by our Tunisian colleagues.

Contiguity of sedimentation: The section contains marine sediments and sedimentation was as continuous as it could be at a KaPg boundary. There is a facies change from a grey marl to a black clay (Boundary Clay), at the base of which is a thin dusty layer. This is the fingerprint of continuous sedimentation over the KaPg boundary interval. The Boundary Clay at El Kef is thicker than at the other sections (Brezat, Stevens Klint and Zanamui).

Completeness of exposure: The section can be easily followed along and below the GSSP and can also be followed laterally. The boundary is also to be found at various other hills in the area. Some earlier reports about calcareous microfossils from El Kef were from other sites in the area (Verbeek, 1977, 1979; Perch-Nielsen, 1979). Also, Saq (1971, 1980) and Donze (1981, 1982) described faunas and flora from other sections in the El Haia area.

Adequate thickness of sediments: Over 50 m of sediments occurs in the section that contains the GSSP. In the area around the GSSP, some 400 m of section (Campanian-Eocene, see Saq, 1980) is available for study.

Abundance and diversity of well-preserved fossils: The section is rich in microfauna as well as macrofauna, including a rich macrofauna, and spores. The rich assemblages allow easy correlation to sites richer in microfossils such as Brao, Manighelii, Stevsh Klint and Zanamui.

Favourable facies: The marine facies of the GSSP is favourable to the preservation of the boundary clay and the surrounding marine sediments. The boundary clay is free from structural complications; this permits a fairly easy correlation to other sections with similar facies. The boundary clay is an asset rather than a reason to view the section as suspect.

Amenability to magnetostratigraphy and geochronometry: Neither magnetostratigraphy nor geochronometry are available at the section near El Kef.

Correlation of the GSSP with elsewhere

Correlation by planktic foraminifera: After Saq (1960) and Donze (1981), who gave summary accounts of Maastrichtian and Danian species from El Kef, Smir (1982) prepared more detailed investigations on Saq (1960), Keller (1969b, 1980), Keller and Lindinger (1989) and Brinkhuis and Zacharias (1980) placed the KaPg boundary following different criteria. While Keller and Smir used the base of the Boundary Clay, Brinkhuis and Zacharias chose the extinction of Cretaceous planktic foraminifera, which coincides with the first appearance of the dinoflagellate Danses californicae. Due to the reduced thickness of the lowermost planktic foraminifera Zone P1 in the El Kef zone, this can not only be subdivided more into other sections, but subzones P1a and b, which are present only in a few sections, have been added below it.

Correlation by calcareous nanofossils: Bramlett and Martin (1964) first studied calcareous nanofossils from Tunisia in a KaPg boundary section. Brench and Sissiguen (1977) give the first account of a series of samples from El Kef Perch-Nielsen (1979, 1980, 1981, 1982) and Traum and Geyl (1980) studied the KaPg boundary section in more detail. At the GSSP section, the uppermost Maastrichtian is characterized by a rich assemblage and the presence of the marker facies. There is a slight increase in Bradoraphora bagleyi at the top of the Boundary Clay, Bambballithus sparsus, a very rare form, the first occurrence of which has often been used to define the base of the Danian, was found only about 3 m above the basal Boundary Clay.

Correlation by palaeobotany: Donze et al. (1981), Brinkhuis and Lovenb (1988) and Brinkhuis and Zacharias (1988) have published their studies of dinoflagellates, acritarchs, pollen and spores from boundary sections near El Kef. There is no mass extinction of dinoflagellates across the KaPg boundary. The first occurrence of Danoes californicas, while occurring at the base of the Boundary Clay in Scandinavia, was only found some 10 cm above the base of the Boundary Clay in El Kef.

Correlation by ostracodes: Donze et al. (1982) presented investigations of the ostracodes across the KaPg boundary from the upper Campanian through the upper Paleocene and early Eocene. They did not study the KaPg boundary to the level of detail that has been accomplished with the other microfossil groups. Some 7 species seem to have their first occurrence at or near the KaPg boundary, while some 14 species appear across the marine section to continental sections: The GSSP section near El Kef contains one main feature that allows for a direct correlation of this marine section with continental sections: the Ir anomaly at the KaPg boundary is a widespread occurrence, many localities have been described in which the KaPg boundary anomaly is usually identified by the pollen extinction horizon in association with the Ir anomaly and, at many localities, the presence of shocked quartz, bronzite, pleonectreite and disappearance of the dinoflagellate Aulopilorus assemblage just below the Ir anomaly is followed by a sawtooth feature in the microscopic chert, with disappearance of fern spores. These features (Tschudi et al., 1984) are just below the boundary. Such a feature has also been found in the marine realm by Sant and Sant (1986) and correlated with the planktic foraminiferal Zone R0. Hollo spores significantly which in a mm in diameter have been found at the boundary layer in continental sections. Some are thought to represent melt droplets formed during an impact.

Accessibility and conservation

The GSSP site is easily accessible. It is an area far enough away from a major town (El Kef, ca. 8 km) to be an unlikely site of development in the near future. It is close enough to a small village to be within short walking distance of a paved or dirt road. The local farmers have their fields on the top of the hills, where the land is relatively flat, but leave the steeper sides of the ravines unused. Aberration to continue will produce a scree that will cover the hillside, but can be removed with a hoe.

Discussion and conclusion

It has been pointed out by some of the working group, the section does have some weak points and is not ideal. It is generally recognized, however, that it is unlikely that an ideal section will ever be found. Most members of the Working Group obviously decided that the weaknesses of the El Kef were minor compared to those of the other sections, or that its strengths were more important than those of the other sections. The KaPg boundary is unique in

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Studies since the original proposal

Geochemical and mineralogical analyses: At the El Kef section, many criteria allow a worldwide correlation of the GSSP (Figure 2). The most useful ones are the meteorite impact evidence (Ir anomaly, Ni-rich spinels, etc.), which is concentrated in the basal part of the Boundary Clay (see above). Robin et al. (1991) and Rocchia and Robin (1998) confirmed the high concentrations of iridium and other PGEs in K/Pg boundary sediments at the El Kef GSSP, already described by Katsiy and Kühnenthal (1983). Although delivered by a very brief event, Ir is observed over a stratigraphic thickness of sediments simulating a long duration phenomenon. The Ir distribution shows a millimetre-thick pulse-like feature occurring in perfect coincidence with the beginning of the biological crisis. This feature is superimposed to a diffuse component extending over about two metres of sediments from the upper Maastrichtian to the Danian Puruvulgarogolobertiina exquitina Zone. As far as the diffuse component in the Danian is concerned, its duration agrees with the estimated residence time of Ir in sea-water.

The pulse-like feature is associated with crystals of Ni-rich spinel, a mineral derived from meteoritic material. This pulse, reminiscent of the brevity of the K/Pg event, results from the rapid deposition of a large amount of impact debris dispersed worldwide as a result of the impact event. Robin and Rocchia (1998) observed that the stratigraphic distribution of spinel is confined to a 1–3 mm east coloured layer that coincides with a drastic decrease of the carbonate fraction. This observation clearly shows that the cosmic event and the biologic crisis took place abruptly and developed rapidly, in less than 100 years, consistent with the hypothesis of a large asteroid impact triggering the mass extinction at the end of the Cretaceous. The Ir content analyses from the El Kef section and in other Tunisian sections reveal that it changed according a random pattern (Robin et al., 1998).

Moreover, chemical analyses of spinels from El Kef reveal that they differ from spinels from other sites, even close to El Kef, suggesting the accretion of several objects. This result can be explained by the fragmentation of the bolide, either before the impact (comet break-up) or upon the impact (oblique impact), with dispersion of debris in both cases all over the Earth. Consequently, it has been generally assumed that the K/Pg boundary is marked by the evidence of the meteoritic impact and more precisely by the horizon equivalent to the moment of the impact, i.e., the base of the millimetre-thick K–

| Figure 2 | Integrated stratigraphy across the K/Pg boundary in the El Kef section. | December 2006 |
and more stable conditions at the seafloor towards the *P. pseudobul- 
aisis* biofacies; assemblages seem to recover within 200-300 ky 
after the KPg boundary (Galloway and Coccioni, 2002; Alegret, 2003; Alegret et al., 2004).

**Outgroup:** The first record at the El Kef section was first studied 
by Donce et al. (1982), who recognized 45 species from the Late 
Campanian to the Ypresian. Although several species range through 
the KPg boundary, 11 became extinct around the KPg boundary. 
Many species are common with those recognized by Säul-Benziati 
(1959) in the El Kef section.

**Paleontology:** Paleontological studies of the Cretaceous-Paleo-
ogene interval at the El Kef outcrop were carried out by Ménén (1990) 
who suggested that in the late Maastrichtian time, Northern Africa 
was at the boundary between the African-South American and Euro-
pean provinces. During the transition to the Tertiary, pelychosaur 
*varia* decreased and only European taxa remained. It is possible that a somewhat abrupt event did occur and its record is superim-
posed on that of climate change and regression. Doxoe and Ménén 
(1997) studied the extinctions of microtethys and pelycosperm, 
across the El Kef KPg boundary, concluding that it coincides with 
the beginning of a major biological crisis. A sudden disturbance in 
the chemical conditions of oceanic seawater, linked to the geotectonic event, seems to have been the most active parameter in 
this crisis, preventing the normal tea building processes for the 
calancrean chlorophyllian algae and inducing strongly anoxic condi-
tions in the ocean. At the boundary and in the first centimeters above 
It, Doxoe and Ménén (1997) found a strong acceleration of taxa dis-
appearances, nevertheless, at least two thirds of the last Maastricht-
ian taxa cross the boundary.

**Ammonites:** This group was described for the first time by 
Glaessner et al. (2004); from the terrestrial Maastrichtian at El Kef. 
A rich assemblage, consisting of at least 47 taxa, occurs in the interval 
from meters 7 to 2 below the KPg boundary. They co-occur with a 
diverse foraminifera fauna, including the ammonites *Didymoceras.* 
All these fossils are pyritic, and the ammonites are all nuclei, mostly <20 mm in diame-
ter. The dominance of *Didymoceras* suggests open connections with 
western India along the Southeast Tethys. No ammonites have been 
recovered from the 2-m interval below the KPg boundary in the 
Tunisian basin. This absence could be due to the Signor-Lipps effect 
or more probably to taphonomic problems of preservation, since 
only nuclei of ammonites were found. Furthermore, a similar prob-
lem was evidenced in the Biscay region (southwestern France, north-
er Spain), where initially no ammonites were found in the upper-
most Maastrichtian, but finally ammonites were found in several sec-
tions up to the KPg boundary by Ward et al. (1991).

**Revision of the GSSP**

Since the KPg Working Group finished its studies and the GSSP 
was approved and ratified in 1991, ICS and ISPS were alerted that 
the site of El Kef is poorly preserved and the exact location of the 
GSSP could not easily be identified. During the International Work-
shop on the Cretaceous-Tertiary Transition (May, 1998) in Tunis, 
the El Kef section and two other apparently complete KPg sections 
(Elles and Ain Settara) were visited. According to Rennaut and 
Adams (2002) the field inspection showed that the El Kef section is 
indeed badly overgrown, they had difficulty in finding the KPg 
boundary. However, 30 m can be located as it is placed a few meters 
below a tree, 20 m downstream of an electric line. 

The best solution nevertheless, seems to be to maintain 
the GSSP at the El Kef section and eventually designate auxiliary sec-
ctions, Zaghibi-Türk et al. (2001) proposed the Elles section as a 
new stratotype or at least a par stratotype for the KPg boundary, 
because the Elles section expresses a better KPg interval exposure than 
the El Kef section. Nevertheless, a small hiatus has been identified 
by Art et al. (1999) 6.5 meters above the KPg boundary in the base of the 
Parak应在bunias pseudobulbianus Zone, but it is an excellent 
auxiliary section as the KPg boundary is continuous. The three 

![Photograph of the GSSP](image.png)

**Figure 3** Photograph of the GSSP. A—Overview of the access 
to the GSSP from the road to Medjeuce, the small village on the 
right and the section on the left. B—Overview of the GSSP 
locally, small village on the right, artificial lake and electric line 
on the left and the section in the middle C—Overview of the 
GSSP site where the trench was excavated.

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Figure 4 Photographs of the K/Pg boundary. A: Trench across the K/Pg with a hammer, a scale and the marker put in place at the boundary. B: Detail of the K/Pg boundary with a Tunisian coin as a scale on the ruddy layer.

xiectly reestablished at the base of the Boundary Clay, a very distinct and precise lithological level, in the section near El Kef, Tunisia. Also, the chairman of the ISPS has sent an official letter to the Tunisian authorities requesting the protection of the site. Several geologists of the Tunisian Geological Survey recently visited the GSSP in order to prepare for its protection.

The GSSP for the base of the Danian, corresponding to the Cen- trosaurus/Aptosaurus boundary as defined at the base of the Boundary Clay in the section near El Kef, Tunisia fulfills most of the requirements for a GSSP set out by Jemane et al. (1996). According to the data in the original definition and in the many papers published subsequently on different aspects of the El Kef section, the GSSP is characterized by the following criteria useful for correlation:

1. The K-Pg boundary is marked and overlain by a 1–3 mm thick ruddy colour facies fenestrius layer composed of reddish hemispheric and goethite laminae. This layer contains less than 1% CaCO3, a maximum of TOC (Total Organic Carbon), distinct excursions in the stable isotopes ¹³C and ¹⁸O and the meteorite impact evidence (e.g. sooty, Ni-rich spherules, etc.). This key layer only a few millimeters thick is the result of the meteorite impact, and concentrates all its evidence in distal areas. The K-Pg boundary is precisely defined by the haemiporiferous corals corresponding to the moment of the meteorite impact. This implies that in the proximal areas of the Chicxulub crater (Vucetich, 1998), the K-Pg boundary must be placed at the base of the ruddy thick impact-related clastic unit, which is therefore Danian in age.

The K-Pg boundary coincides with the most significant extinction in the history of the planktonic foraminifera. The mass extinction suddenly affected more than 70% of the species, which may well reach 90% of the species considering most of the globotruncanids present in the Boundary Clay as reworked (Figure 5). The uppermost Maastrichtian belongs to the Khulsampolithus ayoromoensis Zone, but this species is very rare in the El Kef section. Planktonic foraminifera became extinct at the same time and is more abundant and rare (if the uppermost Maastrichtian, can be used alternatively (Artigas et al., 2001)). The first Danian planktonic foraminiferal assemblages are dominated by Globorotalia, disaster taxa that bloomed immediately after the K-Pg boundary. The lower Danian is characterized by the Globorotalia crenulae Zone, followed in succession by the Parvicostatumglobocassidimorpha equispira Zone and the Paragloborotalia pseudoplacolithes Zone. A high-resolution planktonic foraminiferal stratigraphy was proposed and applied to the El Kef section by Arenillas et al. (2004).

A similar major mass extinction event at the K/Pg boundary is also observed in the calcareous nannoplankton. According to

Figure 5 Planktic foraminifera species range in the El Kef section (modified from Arenillas et al., 2000).

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Pospichal (1994) the uppermost 4 m of Maastrichtian marls reveal no extinctions and show no trends to indicate that ecologic stresses such as temperature change foreshadowed the K/Pg event in the Tethyan region. Cretaceous nanofossil specimens present above the K/Pg boundary at El Kef are interpreted to have been reworked, rather than having survived the K/Pg event. The uppermost Maastrichtian belongs to the Micula prismii Zone and the lower Danish to the zone NPI, characterized by Neobulboceras ronneli at the base. Neobulboceras parvulum in the middle and Ceratolithus ultimus at the top.

In contrast to planktic nanof- and microfossils, the small benthic foraminiferal assemblages did not suffer a mass extinction at the K/Pg boundary; extinctions were fewer in deeper than shallower water settings. However, the outer shelf, upper bathyal sections of Ain Setta and El Kef record a dramatic change in the structure of benthic foraminiferal assemblages across the K/Pg boundary (e.g. Speijer, 1994; Peryt et al., 2002 and Alegret et al., 2004). Diverse and heterogeneous assemblages from the uppermost Maastrichtian were suddenly replaced at the K/Pg boundary by taxonomically impoverished assemblages, strongly dominated by epifaunal morphgroups. The extinction or temporary emigration of most infaunal morphgroups was the result of a sudden breakdown and a decrease in the nutritious food supply resulting from a sudden mass extinction of the primary producers, triggered by the impact of the K/Pg asteroid. The extinction of Bolivinoides draco at the K/Pg known worldwide from many sections allows recognition of the base of the Campanian–Maastrichtian (BM) Zone of Berggren and Miller (1989) also in the El Kef section (Figure 6).

In conclusion, the main criteria defining the K/Pg boundary and the correlation among them are shown in Figure 2. The GSSP for the base of the Danian Stage defining the K/Pg boundary at the base of the boundary clay is overlain by a rusty red layer containing a peak of Ni-rich spilit, which is more concentrated than the iridium anomaly. This implies that all the sediments generated by the meteorite impact belong to the Danian. This millimetre thick layer, containing the evidence of the meteorite impact and other significant geochemical changes, coincides with a sudden catastrophic mass extinction event, which strongly affected the planktic environments. This mass extinction defines the top of the Atheresthes muscatensis Zone (Plankton foraminifera and the top of the Micula prismii Zone of the calcareous nanofossils).

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<th>Benthic foraminifera species ranges in the El Kef section. (Modified from Alegret, 2003)</th>
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Figure 6: Benthic foraminifera species ranges in the El Kef section. (Modified from Alegret, 2003)

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all the other members of the Tunisian Research Unit "Dynamique des Bassins Sedimentaires, Paléoenvironnements et Structures Géodésiques (DSP)"; Lamia Zili, Mohamed Soua and Amel Chakerou for their collaboration in the field trips.

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