Palynological study of the Pliensbachian-Toarcian transition of the Traras Mountains (northwestern Algeria)

Louisa Samar, Abbas Marok, and Choukri Soulimane

Abstract

A palynological study of the Late Pliensbachian-Early Toarcian deposits in the Traras Mountains (NW Algeria) identified sporomorphs (spores and pollen grains) associated with acritarchs and algae unknown in this Algerian basin at this time. Seeking to characterize the Pliensbachian-Toarcian transition, the results of qualitative and quantitative analysis of pollen assemblages generated new stratigraphic information on the lower limit of Bayada beds which have already been established by ammonites, brachiopods and foraminifera.

Keywords

Traras mountains • Algeria • Pliensbachian • Toarcian • Palynology

1 Introduction

The Traras Basin (Fig. 1a) has been the subject of several studies: structural [1], biostratigraphic and sedimentological [2] which allowed it to be integrated palaeogeographically into the Tlemcenian field. During the Pliensbachian-Toarcian transition, the Traras basin was marked by major paleo-environmental and paleo-oceanographic changes. They were correlated with the events of the western Tethys. In particular, we cite sea level variations, carbonate production crisis, δ^{13}Cand δ^{15}N geochemical disturbances and an anoxic ocean event (T-OAE) [3–5]. In the present work, and through the study of two sections (Benzerka and Mellala, northern part of the Traras basin) (Fig. 1a), we provide information for the first time on the palynological components of the Lias in Algeria. The systematic inventory of the different palynomorphs (spores, pollen grains, acritarchs and algae) aims to characterize the Pliensbachian-Toarcian transition as far as possible.

L. Samar
Division Technologies et Developpement (DTD), Sonatrach, Avenue du 1er Novembre, Boumerdès, Algeria

A. Marok (✉) · C. Soulimane
Department of Earth and Univers Sciences, University of Tlemcen, B.P. 119 Tlemcen, Algeria
e-mail: a_marok@yahoo.fr

2 Stratigraphic Framework

As part of the Tlemcenian domain, the two selected sections (Figs. 1b, c) will be described in detail.

2.1 Benzerka Sect. (32, 65 m Thick) (Fig. 1b)

This section shows the following lithostratigraphic succession.

Tisseddoûra Limestone Fm. (5.90 m): it is represented by brecciated limestones, bioclastics, followed by clay limestones. Upwards, it changes to marl-limestone alternations. The macropaleontological content (*Tetrarhynchia ageri* and *Spiriferina* sp.), on the one hand, and micropaleontological ones (namely the benthic foraminifera *Lingulina tenera carinata*, *Lenticulina acutiangulata* mg. *Lenticulina*, *Lenticulina*, *Lenticulina gottengensis* mg. *Lenticulina*, *Marginulina prima*, *Spirillina infima*, *Bolivina liasica*, *Lingulina tenera tenera*), on the other hand, give a Late Pliensbachian age (Algovianum Zone).

Bayada Fm. (26.75 m): it is essentially a marl-limestone alternation (Late Pliensb chian-Early Toarcian) (Emaciatum-Levisoni Zones).

2.2 Mellala Sect. (47 m Thick) (Fig. 1c)

Located a few meters from the road (Ghazaouet-Nadroma), the Mellala section is represented essentially by the "Bayada Beds" which consist of marl and limestone alternation. The lithostratigraphic succession shows from bottom to top:

M. Boughdiri et al. (eds.), *Paleobiodiversity and Tectono-Sedimentary Records in the Mediterranean Tethys and Related Eastern Areas*, Advances in Science, Technology & Innovation, https://doi.org/10.1007/978-3-030-01452-0_51

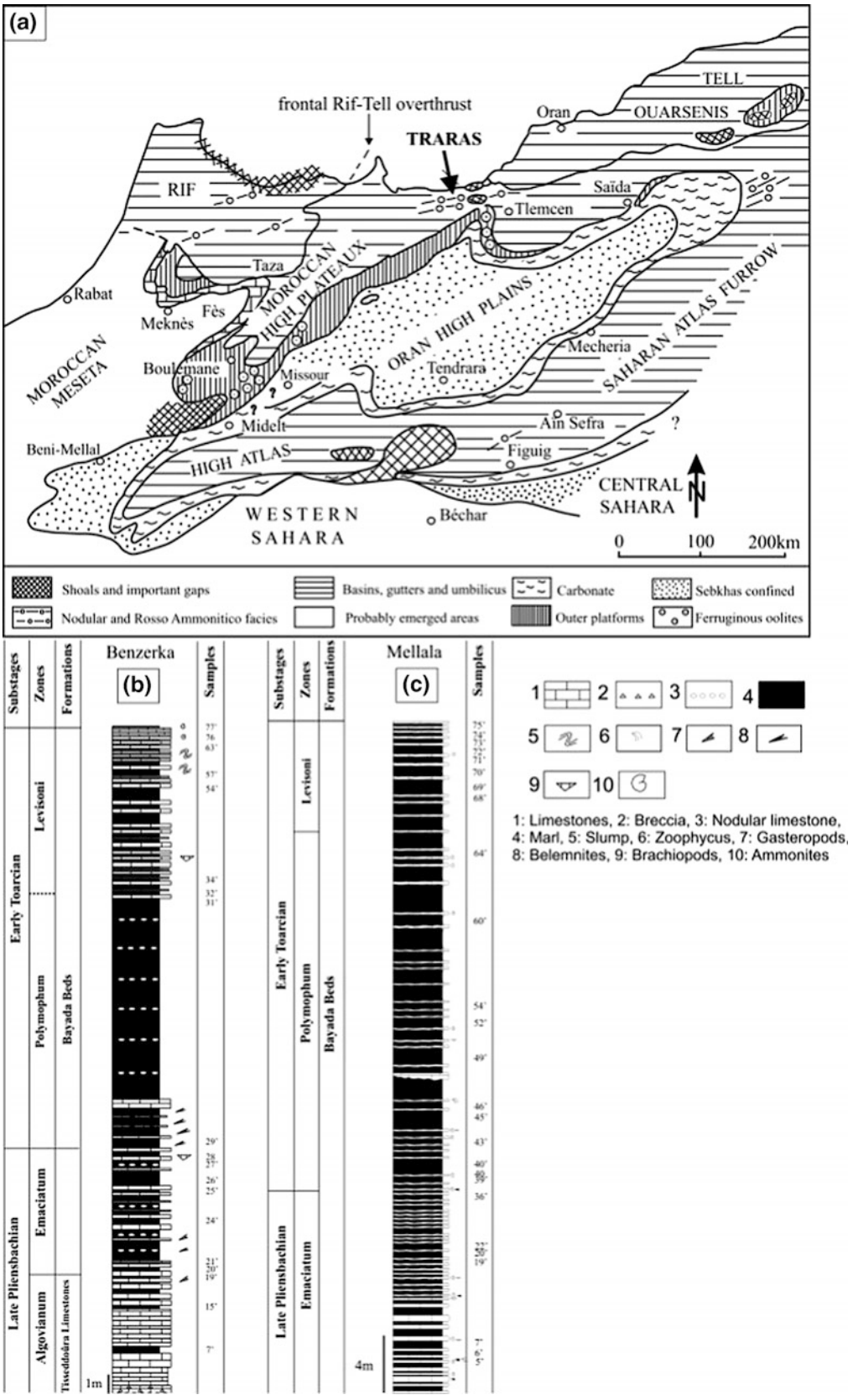

Fig. 1 Location map of the study area (**a**) (after [3]) and stratigraphic column of the Benzerka and Mellala sections (**b** and **c**)

- 6.20 m: alternation of marls and decimeter-thick beds of well-stratified marly limestone, very rich in ammonites, belemnite rostra and brachiopods.
- 7.80 m: alternation of marls and centimeter-thick beds of marly limestone with nodular appearance. The rich macrofauna is mainly represented at the top by the ammonite, *Paltarpites paltus* and *Dactylioceras* (*Eodactylites*) *pseudocommune* indicating the transition between the Late Pliensbachian (Emaciatum Zone) and the Early Toarcian (Polymorphum Zone).
- 25.25 m: alternation of marls and centimeter to decimeter-thick beds of marly limestone with a nodular appearance. Note the presence at the base of zoophycus and some brachiopods and ammonites.
- 07.75 m: marls and centimeter to decimeter-thick beds of marly limestone.

Note that the stratigraphy of this section was described by Elmi et al. (2009). For example, brachiopod-associated ammonites and foraminifera were used to date the Late

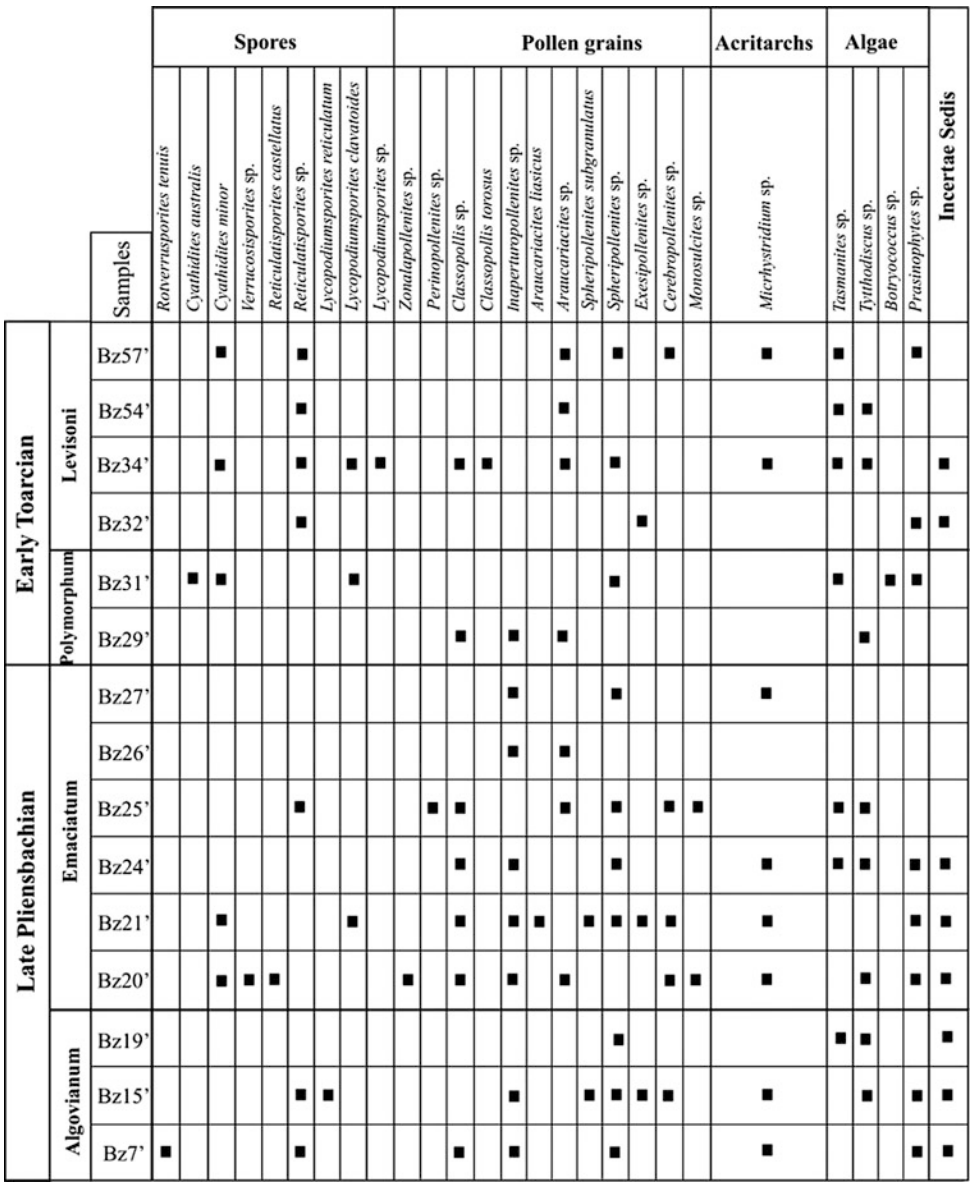

Fig. 2 Distribution of palynomorphs in the Benzerka section

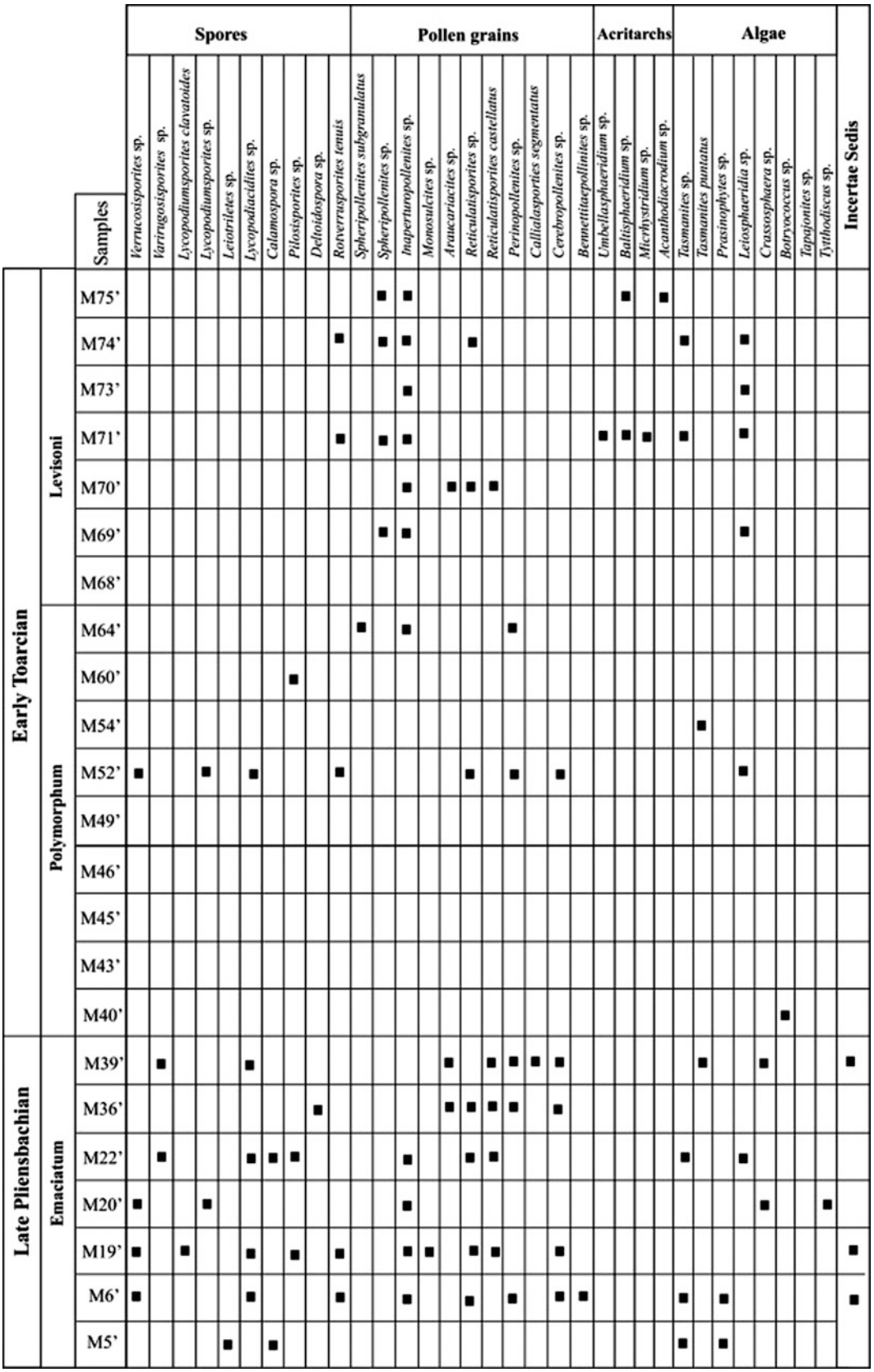

Fig. 3 Distribution of palynomorphs in the Mellala section

Pliensbachian (with the Emaciatum Zone) and the Early Toarcian (with the Polymorphum and Levisoni Zones).

3 Analysis of Palynological Assemblages

Quantitative analysis showed a predominance of the terrestrial elements represented by spores and pollen grains along the Late Pliensbachian- Early Toarcian interval (Figs. 2 and 3). Thus, we have been able to note the following quantitative variations:

- Of the Late Pliensbachian (Algovianum-Emaciatum Zones): the "Tisseddoûra Limestones" (Algovianum Zone), the ten (10) samples of the Benzerka section yielded spores and pollen grains consisting of: *Rotverrusporites tenuis*, *Reticulatisporites* sp., *Zonapollinites* sp., *Araucariacites liasicus*, *Lycopodiumsporites reticulatum*, *Classopollis* sp., *Inaperturopollenites* sp., *Spheripollenites subgranulatus*, *Spheripollenites* sp., *Exesipollenites* sp., *Cerebropollenites* sp., associated with an acritarch, *Micrhystridium* sp. and the algae: *Tasmanites* sp., *Tythodiscus* sp., *Prasinophytes* sp. and forms whose determination remains unfortunately very difficult (*Incertae Sedis*). In addition, the palynological residues of eighteen (18) samples from the Bayada Beds (Emaciatum Zone) contained palynological assemblages consisting of spores and pollen grains (*Varirugosisporites* sp., *Leiotriletes* sp., *Lycopodiacidites* sp., *Calamospora* sp., *Piloseporites* sp., *Deltoidospora* sp., *Callialasporites segmentatus*, *Bennettitaepollinites* sp.). Acritarchs and algae are represented (*Tasmanites puntatus*, *Leiosphaeridia* sp., *Crassosphaera* sp., *Tapajonites* sp., *Umbellasphaeridium* sp., *Baltisphaeridium* sp., *Acanthodiacrodium* sp.).
- In the Early Toarcian (Polymorphum-Levisoni Zones): the "Bayada Beds", in the Polymorphum Zone produced a relatively poor palynological assemblage, which included some spores and pollen grains (*Reticulatisporites* sp., *Verrucosisporites* sp., *Lycopodiumsporites* sp., *Rotverrusporites tenuis*, *Lycopodiacidites* sp., *Spheripollenites* sp., *Classopollis* sp., *Inaperturopollenites* sp., *Araucariacites* sp.), associated with scanty and diversified algae (*Tasmanites puntatus*, *Tasmanites* sp., *Leiosphaeridia* sp., *Botryococcus* sp., *Prasinophytes* sp.) and indeterminate forms (*Incertae Sedis*). Acritarchs are completely absent. Moreover, in the Levisoni Zone, the palynological association is dominated by spores and pollen grains: *Cyathidites minor*, *Cyathidites australis*, *Reticulatisporites castellatus*, *Reticulatisporites* sp., *Lycopodiumsporites clavatoides*, *Lycopodiumsporites* sp., *Classopollis* sp., *Classopollis torosus*, *Araucariacites* sp., *Spheripollenites subgranulatus*, *Spheripollenites* sp., *Exesipollenites* sp., *Cerebropollenites* sp., *Inaperturopollenites* sp. accompanied by acritarchs (*Micrhystridium* sp., *Umbellasphaeridium* sp., *Baltisphaeridium* sp., *Acanthodiacrodium* sp.) and algae (*Tasmanites* sp., *Tythodiscus* sp., *Leiosphaeridia* sp., *Prasinophytes* sp.).

4 Conclusion

The qualitative and quantitative results of the palynological assemblages found in the Pliensbachian-Toarcian interval show that the boundary between the Algovianum Zone and the Emaciatum Zone is marked by the appearance of a group of sporomorphs consisting of *Cyathidites minor*, *Verrucosisporites* sp., *Monosulcites* sp., *Lycopodiumsporites clavatoides*, *Zonalappollenites* sp., *Classopollis* sp., *Araucariacites liasicus*, *Araucariacites* sp., *Monosulcites* sp., *Reticulatisporites castellatus.* The boundary between the Polymorphum Zone and the Levisoni Zone is distinguished by the appearance of taxa: *Cyathidites australis*, *Lycopodium* sp., *Classopollis torosus* and *Botryococcus* sp. This palynological study, carried out for the first time in Algeria, allowed us to identify 14 (fourteen) pteridophyt spores, 15 (fifteen) gymnosperm pollen genera, 4 (four) acritarchs and 08 (eight) algae that show a great similarity with palynomorphs found in some northern and southern Tethyan basins.

References

1. Guardia, P.: Géodynamique de la marge alpine du continent africain d'après l'étude de l'Oranie nord-occidentale. Université de Nice, France, Thèse Doctorat d'Etat (1975)
2. Ameur, M.: Histoire d'une plate-forme carbonatée de la marge sud-téthysienne: l'autochtone des Traras (Algérie occidentale) du Trias supérieur jusqu'au Bathonien moyen. Documents des Laboratoires de Géologie de Lyon **150**, 1–339 (1999)
3. Elmi, S., Marok, A., Sebane, A., Alméras, Y. : Importance of the Mellala section (TrarasMountains, north-western Algeria) for the correlations of the Pliensbachian-Toarcian oundary. Volumina Jurassica **4**, 158–160 (2009)
4. Reolid, M., Marok, A., Sebane, A.: Foraminiferal assemblages and geochemistry for interpreting the incidence of Early Toarcian environmental changes in North Gondwana palaeomargin (Traras Mountains, Algeria). J. Afr. Earth Sc. **95**, 105–122 (2014)
5. Soulimane, C., Reolid, M., Marok, A.: Ostracod assemblages from the uppermost Pliensbachian and Lower Toarcian of the Traras Mountains (Tlemcen Domain, north Algeria). Arab. J. Geosci. **10**(393), 1–24 (2017)