Discovery of an Upper Campanian deformational phase fossilized by phosphatogenesis, Qalaat Al Mahalbeh, Coastal Range, Northwest Syria

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Introduction

The new discovery is located in the northern Coastal Range which is a N-S elongated monocline whose eastern flank is downthrown by Ghab Depression western faults (Fig. 1). The monocline's western flank dips gently westwards. Triassic rocks outcrop in the monocline's core and is overlain by sequences continued till Quaternary, Dubertret, (1966) Ponikarov (1966), Youssef et al. (1979), Brew et al. (2000), Mouty and Saint-Mark (1983). The deformational phase is discovered in the Upper Campanian hemi pelagic marly and clayey limestone (Fig. 1).

Methodology

An integrated methodology consists of detecting a unique syn-sedimentary jointing predate the Senonian phosphatic deposition, mapping and sampling it in details, facieses analysis, dating the event through micro fauna (planktonic foraminifer) analysis (J-P. Bellier) and nannofauna (coccolith) analysis (C. Müller) and synthesizing it within the tectono-paleogeographic evolution of the northern Arabian platform during that time.

Results

A six open joints set (Figure 2-1 & 2-4) was detected in one of the Upper Campanian hemi pelagic marly and clayey limestone levels, locally impregnated by organic matter, Bearing small benthic and little plankton foraminifer at Qalaat Al Mahalbeh, Coastal Range. The N52°E oriented joints widen (3-10 cm) (Figure 2-4) generally northwestwards.

Figure 1. Location map of Qalaat Al Mahalbeh.

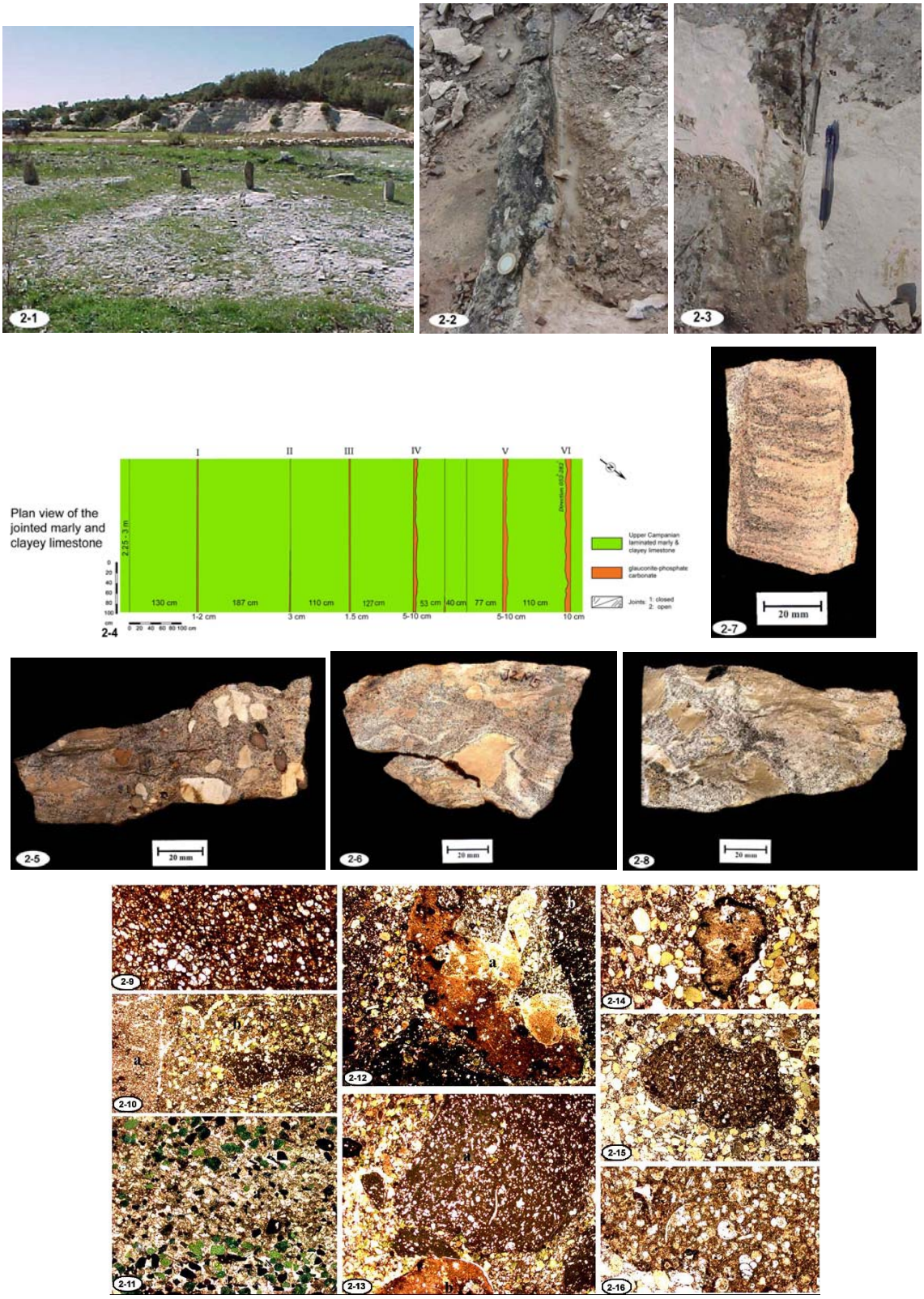

Figure 2. Synthetic comprehensive plate of the Upper Campanian jointed sedimentary series, plan view of the joints configuration, details of the Vth mapped joint, macro and micro facieses of the phosphatic glauconitic carbonate sediments that fills the Vth joint. Magnification: 2-9:8X; 2-10:5X; 2-11:10X; 2-12:5X; 2-13:7X; 2-14:10X; 2-15:10X; 2-16:25X.

Resembling micro basins, particularly the Vth one, they are filled by distinctive sedimentation

represented by glauconitic-phosphatic-carbonate sediments, laminated clearly at the top and characterized by the presence of soft to semi-lithified gravels (Figure 2-6) snatched from the enclosing sediments to aggregate at the joints' rims and central bottom with no evidence for emergence.

Details of Figure 2

2-1: Field exposure of the Upper Campanian phosphatic glauconitic carbonate series, looking southwest. Open joints are marked by milestones in the middle of the photo. **2-2:** Details of the Vth joint, note the striking color contrast between the filling phosphatic glauconitic carbonate and the enclosing clayey limestone. **2-3:** Close up of the same joint presenting a semi-consolidated gravel snatched from the enclosing rock, deposited synchronously within the joints' filling sediments. **2-4:** Plan view of the joints configurations.

From 2-5 to 2-8: macro facieses of the Vth joint filling sediments showing the irregularities of the joint's rims which represent the sites of the snatched semi-consolidated gravels deposited synchronously within the joint's filling sediments. 2-5 and 2-8 are the western and the eastern extremities, 2-6 and 2-7 are the bottom and the top of the joint center.

2-5: Type of the sediments marked by enrichments of consolidated to semi-consolidated polygenic gravels derived from the enclosing rock and other rock types. **2-6:** An irregular semi-consolidated gravel at the joint's central bottom whose morphology controlled the overlying laminated sediments. **2-7:** The laminated sedimentary structure of the overlying phosphatic glauconitic carbonate. **2-8:** Type of the sediments marked by the deposition of semi-consolidated snatched gravels.

The above described macrofacieses of the Vth joint give the impression that this joint looks like a micro basin whose sediments differentiate from the rims to center.

From 2-9 to 2-16: Microfacieses of the joint's sediments:

2-9: Biomicrite with planktonic foraminifer and some benthic small foraminifer. It represents the microscopic facieses of the Upper Campanian enclosing carbonate subjected to jointing. **2-10:** The contact of the facieses of first open joint's wall (A) and the granular phosphatic glauconitic carbonate (B). **2-11:** The microscopic facieses of the Vth joint top. It is represented by two granular arenitic carbonate laminas rich in phosphate grains, separated by another biomicritic lamina bearing some phosphatic grains.

From 2-12 to 2-16: Different microscopic facieses of the Vth joint sediment:

2-12: Heavily reworked phosphatic nodules (A) with microscopic inclusions, organic in particular. (B in this photo), (A in 2-13) and (A in 2-15) are semi consolidated gravels snatched from the enclosing rock, bearing specific planktonic foraminifer. **2-13:** (B) and **2-14** (A) phosphatic nodules of different epigenetic phases bearing organic and glauconitic inclusions. Note the abundance of rounded and semi-rounded glauconitic grains within the above described facieses of the Vth joint sediment. **2-15:** Organic inclusions composed of varieties planktonic forminifer with some pelagic organisms' shells and thorns. **2-16:** Details of the semi-consolidated gravel appear in 2-15.

The morphology and the site of the snatched gravels on one hand, and the observed sedimentary structures on the other hand confirm the prevalence of hydrodynamic effects on the sedimentation milieu's floor and a change in its energy associated by reworking of some sediments, in particular phosphate nodules. The Structures of the enclosing marly and clayey limestone at the joints rims indicate that they were either soft or semi-lithified when the joints-forming syn-sedimentary deformational phases occurred. This was followed by an important phosphatogenesis phase accompanied by occasional hydrodynamic effects, transportation, varied-energy and stages sedimentation. This played a key role in filling and fossilizing the joints before the hemi pelagic glauconitic-phosphatic-carbonate sedimentation resumed during Late Upper Campanian. The detailed facieses analysis of the joints filling sediments and the structures of the enclosing sediment in addition to the joints wall morphology, in particular the Vth joint demonstrated in the foregoing (Fig. 2), lead us to suggest the scenario illustrated in (Fig. 3) for their genesis and filling by glauconitic-phosphatic-carbonate sediments.

Conclusion

The planktonic foraminifer and coccolith analysis defined the exact age of the studied series as Upper Campanian, whereas it was previously considered as Maestrichtian. The discovered deformational phase and the associated phosphatogenesis, characterizes this part of the northern Coastal Range. The sedimentation milieu's floor here is seemingly shallower and more agitated than the Coastal Range southern parts. We believe that the paleogeographic sedimentation framework at this part of the range reflected an uplifting of the sedimentation milieu's floor, which was syngentically, deformed and fossilized by phosphatic carbonate sedimentation. This imprint of the deformational phase on the northern Coastal Range is most likely linked with precursor regional tectonic phases depicted this area of the northwestern Arabian plate during Upper Campanian, before the Maestrichtian ophiolite obduction.

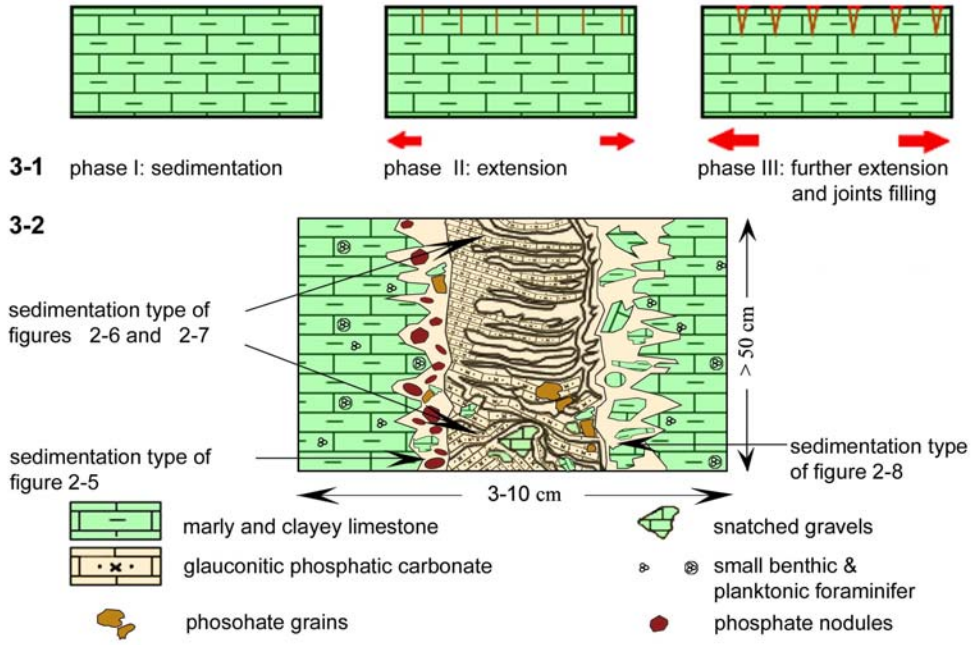

Figure 3: A suggested scenario for: 3-1: syn-sedimentary consequent phases of the joints set genesis. 3-2: schematic description of the Vth joint's filling.

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