S1

| Stages | Stratigraphic division & facies type | Lithology | Sedimentary characters and other observations | Fossil contents |
|---|---|---|---|---|
| PIA-CEN-ZIAN | Unit VI: greyish marls underlined (base) by sulfur levels (90 m) | **b)** - Biodetritic calcareous sandstone, | **b)** Biodetrital calcareous sandstone resting unconformably on the underlying deposits | - fossil fragments |
| ZANCLEAN | | **a) -** Greyish marls with intercalations of 3 yellowish sandstone bars (thickness: 2 to 4 m) with fossil concentrations;<br>Base marked by a bench (0.5 m thick). | a)-The sandstone bars rest unconformably the marls. Hardground on upper surfaces of the first two bar | -Benthic and planktonic foraminifera (sample Ab 49): *G. puncticulata, G.* cf. *crotonensis, Globigerinoides, Neogloboquadrina, Globigerina;*<br>(Sample Ab 46): *Globigerinoides, Globorotalia, Globigerina, Ammonia* sp. (*A. tepida*).<br>- Richness in coral debris (lowermost 0.5 m).<br>-Bivalves, Gastropods,<br>-Planktonic foraminifera (sample Ab 36): *G. puncticulata, Globigerinoides, Neogloboquadrina, Globigerina*;<br>(samples Ab 41 to Ab 46): *G. puncticulata, G. puncticulata padana Globigerinoides, Globorotalia, Globigerina, Ammonia* sp. (cf. *A. tepida*)<br>-Ostracods (sample Ab 46) : *Aurila, Loxochoncha.* |
| | Unit V: coralliferous white marly limestones (15 m) | Alternation of white marly limestone beds and calcareous marls very rich in macrofauna. The bottom of the corallifeours white marly limestones is underlined by corrugated surface and conglomeratic pebbles, indicating a clear discontinuity (*unfonformity*) with the earlier deposits | / | - Pectinids, Ostreids (*Neopycnodonte cochlear*),<br>*Natica* sp., *Turritella* sp., Brachiopoda (*Megerlia truncata*),<br>- Corals: *Dendrophyllia* sp., cf. *Cladocora* cf. *caespitosa*, cf. *Desmophyllum* sp., *D.* cf. *cristagalli, Ceratotrochus* sp. (sampled laterally)<br>- Benthic and planktonic foraminifera (*G. margaritae, Neogloboquadrina, Globigerinoides, Globorotalia, Globigerina*),<br>- Calcareous nannoplankton: *R. cisnerosii, R. pseudoumbilicus, C. pelagicus, H. carteri, Sphenolithus* |
| MESSINIAN | Unit IV: green and ruby clays, variegated clays and green marls (varves) (11 m) | **d**) Greenish sandy marls becoming sandy at the top, boundered at the bottom and at the top by erosion surfaces. The sandy marls (2 m) are unconformably caped by a conglomeratic level (10 cm) | / | d)- Planktonic foraminifera: *Globigerinoides, Globigerina, Globorotalia,*<br>- Calcareous nannoplankton: *Coccolithus pelagicus, Helicosphaera carteri, Discoaster variabilis*, some *Sphenolithus.* |
| | | **c**) Variegated clays (varves) (2, 50 m), crowned by a conformity | **c**) Round, shiny quartz | **c**) Ostracods: *Cyprideis, Tyrrhenocythere* cf. *ruggierii, Amnicyethere* sp., *Zalanyiella venusta*.<br>- Benthic foraminifera (*Ammonia sp.: A.* cf. *tepida*) |
| | | **b**) Red clays « ruby » (1, 50 m) | **b**) Absence of quartz | **b**) Ostracods: *Loxocorniculina Djafarovi, Euxinocythere praebaquana, Amnicyethere* sp., *A.* cf. *accicularia, Camptocypria* sp., *Cytherura pyrama, Z. venusta* |
| | | a) Greenish silty marls (01 m), overcoming a hardground<br>***Discontinuity*** | **a**) Blunt shiny quartz | **a**) Benthic, Planktonic foraminifera (dwarf forms) and broken ostracod tests |
| | Unit III: sandy marls and sandstones (20 m) | **b**) - Channeled yellowish-brown sandstone, containing microconglomerates, evolving towards the summit at conglomeratic levels (centimetric) intercalated at the base of the sandstone banks. Rounded sandstone pebbles cover the hardground | **b**) Hardground with distorted structure. The whole forms a slight back anticline (variable dip: 25 to 30° towards the NNW), NS fracturing | **b**) Hardground characterized by some fossil fragment and ferruginous crusts. Presence of small fossils (Cardiidae: *Pseudocatillus* sp.) among the elements of the conglomeratic intercalations |
| | | **a**)-Yellowish sandy clays and coarse sandstone beds alternating<br>***Discontinuity*** | **a**)-Horizontal oblique and intercross stratifications, (HCS). High % quartz compared to the underlying unit, especially shiny round | **a**) *Chara*-type (*C.* cf.? *hispida*) with some ostracod remains |
| | Unit II: variegated clays (varves) (40 m) | **d**)-Variegated clays (samples Ab 13 to Ab 17) | **d**) - "Round, shiny" quartz grains | **d**) - Benthic (*Ammonia*) and planktonic foraminifera (reworked), ostracods (*Cypreides, Loxonconcha* sp1) |
| | | **c**) - Greenish to greyish unlaminated clays (samples Ab 10, 11 and 12) | **c**) - "Blunt, glistening" quartz grains | **c**) - Benthic and planktonic (*Globigerinoides, Globigerina*) foraminifera, and reworked ostracods |
| | | **b**) - Finely laminated clays at the base (samples Ab1 - Ab 09) | **b**) -Some shiny blunt quartz grains | **b**) - Ostracods (*Cypreides, Loxoconcha* sp1, *Loxoconcha* sp2, *Loxoconcha muelleri,*),<br>- Benthic foraminifera (*Ammonia sp.: A.* cf. *tepida: Elphidium* sp.) |
| | | **a)** - Black shale, sandstone and gypsy conglomerate (sample Ab 0).<br>***Unconformity*** | **a)**- "Blunt, glistening" quartz grains | **a**) - Benthic foraminifera of small size. |
| | Unit I: gypsum | Two bars (thick: 0,5 to 1 m) | Swallow twined gypsum | |

S2

| Stages | Stratigraphic division & facies types | Lithology | Sedimentary marks and other observations | Fossil contents |
|---|---|---|---|---|
| **PIACENZIAN** | **Unit V: greyish marls (67 m)** | - **b**) Greyish marls, intercalations of yellowish sandstone bars (thick: 2 to 4 m) with fossil concentrations; bars underlined (bottom) by blue marl horizons and sulfur levels. | -Syncline structure. | **b**) Benthic and planktonic foraminifera: *G. puncticulata, G.* cf. *crotonensis, Globigerinoides, Neogloboquadrina* group, *Globigerina*.<br>-Bivalves, Gastropoda, *Terebratula* sp. |
| **ZANCLEAN** | | - **a**) Greyish marls underlined by sulfur levels,<br>**Unconformity** | / | a) Benthic and planktonic foraminifera: *G. puncticulata, Globigerinoides, Neogloboquadrina* grp, *Globigerina.* |
| | **Unit IV: coralliferous white marly limestone (15 m)** | -White calcareous marls and white marly limestones with rich macrofauna, comparable to those described in the Djebel El Abiod section.<br>**Discontinuity/Unconformity** | | - Pectinids, Ostreids (*Neopycnodonte cochlear*), *Natica* sp., *Turritella* sp., *Megerlia truncata,*<br>-Corals: *Dendrophyllia* sp., cf. *Cladocora* cf. *caespitosa*, cf. *Desmophyllum* cf. *cristagalli*,<br>-Benthic (*Ammonia* sp.*)* and Planktonic foraminifera (*G. margaritae, Neogloboquadrina* Group, *Globigerinoides, Globorotalia, Globigerina*),<br>-Nannoplankton: *R. pseudoumbilicus, R. cisnerosii, C. pelagicus, H. Carteri*, and some *Sphenolithus*. |
| **MESSINIAN** | **Unit III: variegated clays (varves) and green marls (4.5 m)** | **b)** -Folded greenish marls (2 m), overcoming a horizon of black clay and reddish sand.<br>-Greenish marls<br>**a**) Folded variegated clays (varves) (2.50 m).<br>**Visibility gap** | a)-Quartz : shiny round grains. | **b**)-Benthic and planktonic foraminifera: *Globigerinoides, Globigerina, Globorotalia*,<br>-Calcareous nannoplankton: *C. pelagicus, H. carteri, D. variabilis,* some *Sphenolithus*,<br>**a**) Ostracoda fragments, benthic foraminifera. |
| | **Unit II: sandy clays and sandstones (40 m)** | Channeled detrital sedimentation resting unconformably on massive gypsum: greenish sandy clays (10 m thick) covering gypsum unit. Above, come coarse sandstones, poorly stratified heterogeneous deposits with blocks, which evolve towards alternations of sandstones, microconglomerates, and sometimes conglomerates.<br>**Unconformity?** | -Quartz: shiny round grains.<br>. | *Chara* cf.? *hispida* with some benthic foraminifera |
| | **Unit I : gypsum** | Gypsum blocks. | | |

S3

| Stages | Stratigraphic division and facies type | Lithology | Sedimentary marks and other observations | Fossil contents |
|---|---|---|---|---|
| **ZANCLEAN** | **Unit V: grey marls (12 m)** | -Grey marls at the base which evolve at the top to an alternation of grey marls and limestone.<br><br>-Grey marls | /<br><br>/ | - Planktonic foraminifera: *Globorotalia* Grp, *Globigerina* Grp, *Globigerinoides* Group, *Globorotalia margaritae*.<br>- Calcareous nannoplankton: *Ceratolithus acutus*, *Reticulofenstra cisnerosii*.<br><br>- Benthic and planktonic foraminifera: *Globorotalia margaritae*.<br>- Calcareous nannoplankton: *Ceratolithus acutus*, |
| **M E S S I N I A N** | **Unit IV: grey blue marls (9 m)** | - Grey to blue marls<br><br>- Grey to blue marls<br><br>***Unconformity (?)*** | **a**)- "Blunt, glistening" quartz grains<br>- fault supposed<br><br>- "Blunt, glistening" quartz grains. | - Ostracods (*Cypreides*, *Loxoconcha muelleri* (reworked), *Loxoconcha* sp.1, *Loxoconcha* sp.2, *Tyrrhenocythere pontica*, *Amnicyehere* group., *A. propinqua*).<br>-*Charophytes: Chara* cf? *hispida*<br><br>- Ostracods: *Loxocorniculina djafarovi*, *Euxinocythere praebaquana*, *Amnicyehere* sp., *Cytherura pyrama*, *Tyrrhenocythere* cf. *ruggierii*, *Loxoconcha muelleri.*<br>-Benthic foraminifera (*Ammonia sp.*): *Orbulina*, *Globigerinoides …*<br>-*Charophytes: Chara* cf? *hispida* (pl. 1, fig. 23-24), |
| | **Unit III: sandy clay and sandstone (43 m)** | -Alternation of sandy clays and sandstones (42 m) with a dip of about 30° NW, bordered at the bottom with an unconformity (conglomerates) observed on the grey to brown silt and Variegated clays.<br><br>***Unconformity*** (erosion) | -Horizontal stratification, oblique stratification, hommocky cross-stratification and cross stratification.<br>-"Round and blunt shiny" quartz grains. | *Chara* cf.? *hispida* with some reworked ostracods. |
| | **Unit II: grey brown silt (6 m)** | -Variegated clay (1 m thick) and heterogeneous.<br>- Grey to brown silt with a thickness of around 6 m (T01 to T07).<br>***Unconformity*** | "Round, shiny" quartz grains. | - The presence of some smooth valve shells of ostracods (*Cyprideis*).<br><br>- *Chara* cf.? *hispida*. |
| | **Unit I : gypsum** | Swallowtail twined | | |

| Stages | Stratigraphic division & facies type | | Lithology | Sedimentary marks and other observations | Fossil contents |
|---|---|---|---|---|---|
| **PIACENZIAN** | **Unit IV : sandy marls and sandstone alternation** (47 m thick) | | -Alternation of sandstone bars, marly horizons, sandy marls and lumachellic horizons, corresponding to "Slama" formation (Anderson, 1936). | Discontinuity | -Bivalves (Ostreidae*: Hyotissa hyotis*; Pectenidae), gastropods, scaphopods, traces of biological activities.<br>-Planktonic foraminifera: *Globorotalia* cf. *crotonensis* in the sandy marls (Mazzola, 1971).<br>-Calcareous nannoplankton: *Braarudosphaera bigelowii, Calcidiscus macintyrei, Coccolithus pelagicus, Discoaster brouweri, D. tamalis, D. variabilis, Helicosphaera carteri, Reticulofenestra pseudoumbilicus, Rhabdosphaera procera, Scyphosphaera campanula, S. pulcherrima et Sphenolithus abies*. |
| **ZANCLEAN** | **Unit III: Blue (whitish) marls** (168 m thick) | | -Large blue (whitish) marl expanses corresponding to the "Tarhia" formation (Anderson, 1936), or "Trubi" facies like that described in Sicily. | | - Foraminefera: appearance of *Globorotalia* cf. *crotonensis* (sample: 51).<br>-Calcareous nannoplankton (samples 23 – 49): *Amaurolithus delicatus, A. primus, Discoaster asymmetricus, D. brouweri, D. surculus, D. tamalis, Helicosphaera sellii, Reticulofenestra cisnerosii, R. pseudoumbilicus, Sphenolithus abies,* and *S. neoabies.* |
| | | | | -free gypum blocks non stratified | - Macrofauna (from sample 19): appear bivalves with a fine whitish test (essentially Veneridae), gradually enriched upwards: Ostreidae (*Anadara diluvii, Pelecyora*), Pectinidae, sea urchin radioles, crab claws, gastropods, scaphopods (*dentalia* sp.) and corals (*Ceratotrochus (Edwardsotrochus) pentaradiatus*).<br>-Calcareous nannoplankton (samples 07 – 19): *Amaurolithus delicatus, A. primus, Ceratolithus acutus, C. armatus, C. rugosus, Discoaster brouweri, D. surculus, D. tamalis, Helicosphaera sellii, Reticulofenestra cisnerosii, R. pseudoumbilicus, Sphenolithus abies,* and *S. neoabies.*<br>- Ostracods (sample 23-49) : *Aurila, Loxochoncha, Cytherella, Cytheropteron*, …<br>- Benthic and planktonic foraminifera:<br>*(sample 41-49) :benthic foraminifera : *Ammonia* sp.,<br>*(sample 29-49): *G. puncticulata, G. padana, Globigerinoides, Globigerina, Globorotalia;*<br>*(sample 23) : *G. puncticulata, Globigerinoides, Globigerina, Globorotalia*;<br>- Benthic and planktonic foraminifera (samples 09 – 17): *G. margaritae, Globigerinoides, Globigerina,* and *Globorotalia* ; ( sample 19): small *Globigerinoides, Globigerina,* and *Globorotalia.* |
| **MESSINIAN** | **Unit II: sandy marls** (14 m thick) | | -Yellowish to greyish sandy marls.<br>-The base: pebbles of gypsum, limestone and fragments of diatomites.<br>**Unconformity** | -Faults and folded banks<br>-Abnormal contact (Units II-III) | -Calcareous nannoplankton (samples 01 – 06): *Calcidiscus leptoporus, C. macintyrei, Coccolithus miopelagicus, C. pelagicus, Cyclicargolithus floridanus, Discoaster surculus, D. variabilis, Helicosphaera carteri, Lithostromation perdurum, Pontosphaera japonica, Reticulofenestra pseudoumbilicus* and *Sphenolithus abies*.<br>- Planktonic foraminifera (samples 03 – 06): *G. margaritae, Globigerinoides, Globigerina, Globorotalia*.<br>- Ostracods (*Cypreides*). |
| | **Unit I : Calcareous gypsum** | | Swallowtail twined gypsum + calcareous gypsum | | |