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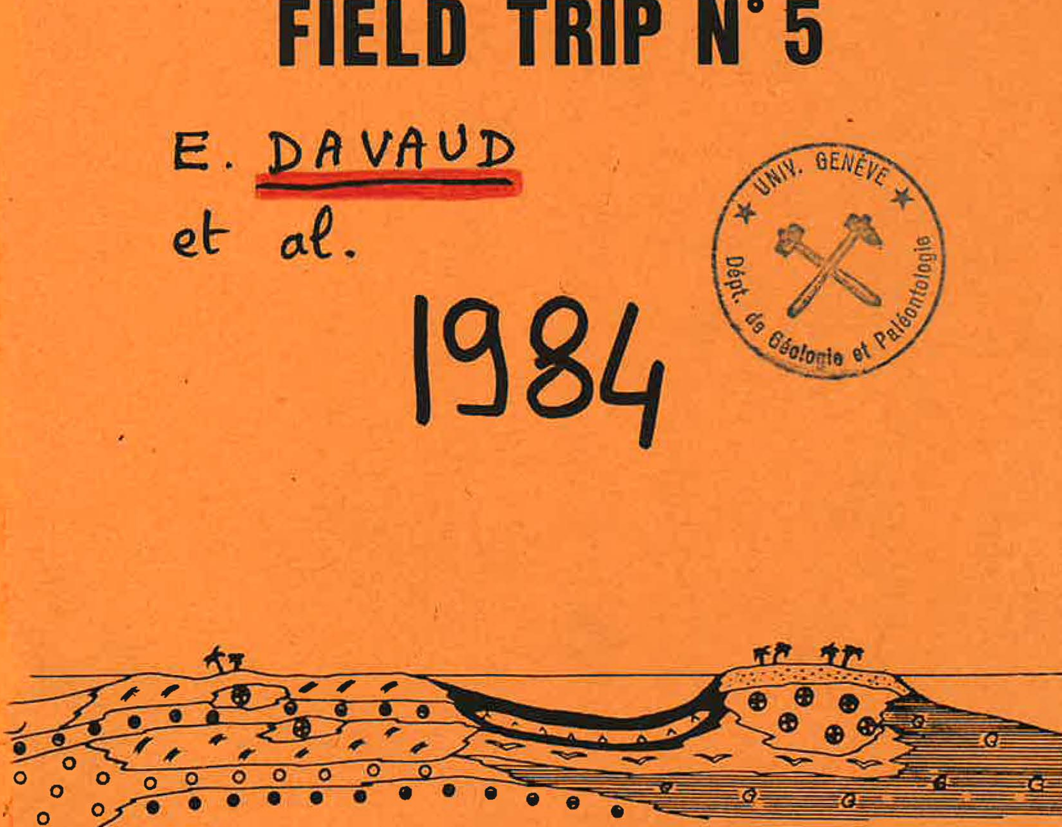

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TRIP 5

UPPER JURASSIC CARBONATES IN THE AREA SURROUNDING GENEVA

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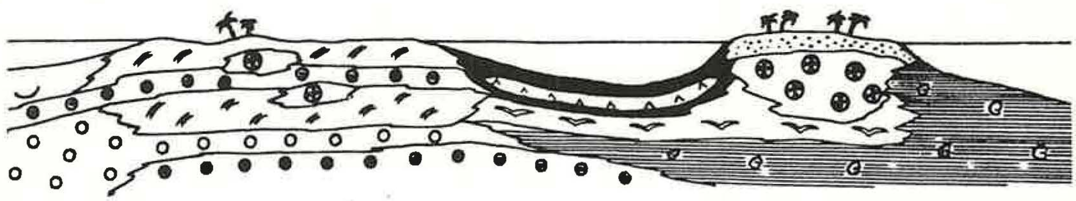

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INTRODUCTION

The Jura mountains form an arc over 300 km long, extending from northeastern Switzerland (Lägern) down to the north of Lyon, France. The highest point of the chain, 1700 m, is situated in the neighborhood of Geneva.

Two zones can be distinguished geomorphologically and by their tectonic characteristics:

1. A strongly folded zone to the southeast, bordering the Molasse basin;
2. A tabular zone to the northwest, which is composed of compartments separated by strongly deformed belts.

Major folding took place during the Late Miocene and the Pliocene. The Mesozoic cover was detached along the Triassic evaporite horizons and displaced over a distance of up to 25 km.

The Jura mountain chain consists essentially of carbonates, whose ages range from Triassic to Upper Cretaceous. The Upper Jurassic and the Lower Cretaceous are especially well exposed in the western part of the chain. They consist of alternating pelagic and shallow-water sediments deposited in the internal zone of the northwestern margin of the Tethys.

At the beginning of the Tertiary, the Jura emerged and suffered intense karstification. The Bresse graben, the Rhine graben and the Molasse basin began to subside in the Oligocene, and were subsequently filled with siliciclastic sediments during the Oligocene and Miocene.

(For more details refer to TRÜMPY 1980).

The two outcrops visited during this field trip (fig. 1) exhibit the principal facies which are encountered in the Upper Jurassic of the southern Jura (BERNIER 1983). Fig. 2 summarizes the stratigraphy of this area.

In the Upper Kimmeridgian, a large carbonate platform began to develop, which prograded over pelagic facies (marls with ammonites) to the southeast. Further out in the basin, pelagic sedimentation continued up to the Barremian.

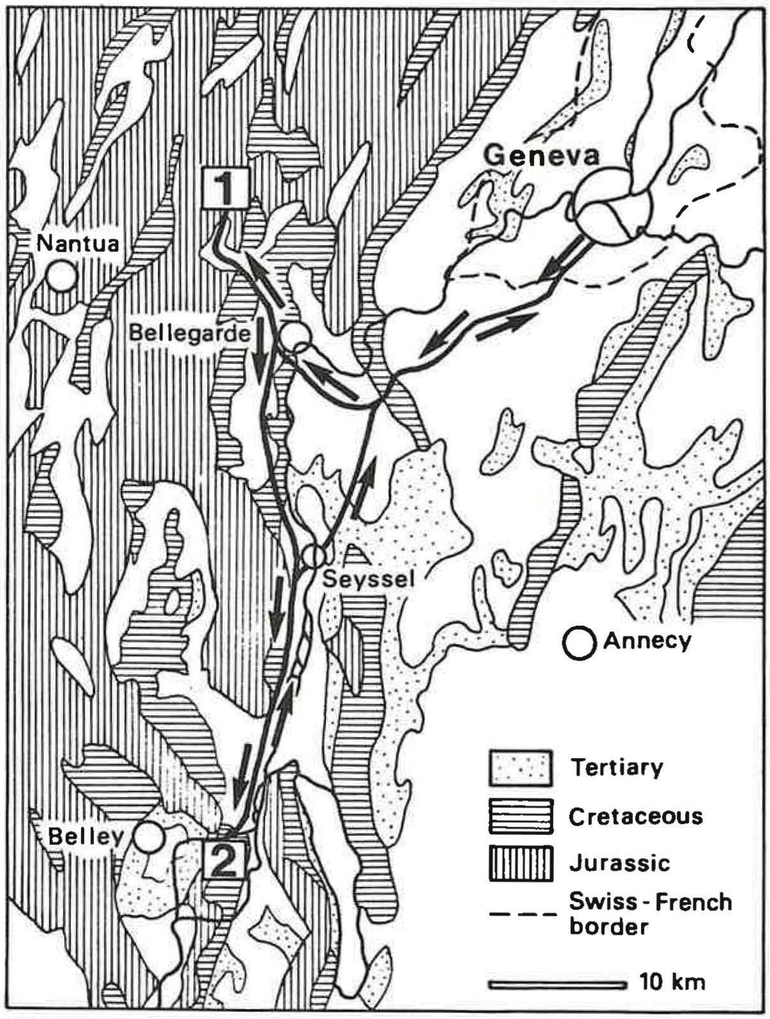
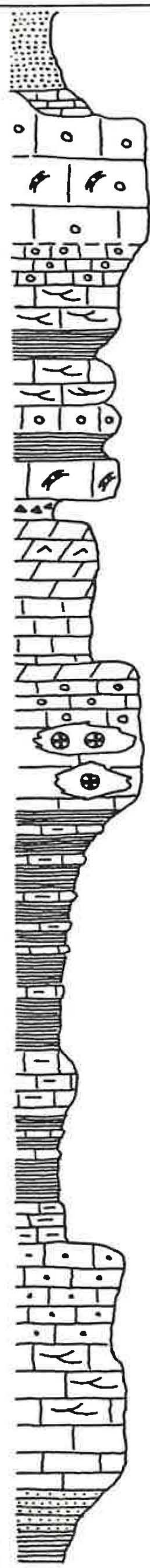


Fig. 1 - Simplified geological map with itinerary.
1: St. Germain-de-Joux
2: Cluse de Bart

The outcrops studied here correspond to a zone situated internally from the platform margin. Transitional facies of sponge-bearing mudstones and oolitic-bioclastic wackestones led to the reef facies of stop 1. Later on, shallow lagoons and tidal flats predominated (stop 2).



AGE		M.	LITHOLOGY	FOSSILS	ENVIRONMENT
	OLIGOCENE		sandstones	ostracods	brackish
	UPPER CRETACEOUS		micritic lmst.	pelag. foram.	pelagic
LOWER CRETACEOUS	APTIAN/ALBIAN BARREMIAN	100	oolithic/algal limestone	rudists, benth. foram. algae	shallow subtidal
LOWER CRETACEOUS	HAUTERIVIAN	100	oolithic lmst.		oolithic bar
			crinoidic lmst. marls	oysters ammonites	shallow subtidal pelagic
LOWER CRETACEOUS	VALANGINIAN	40	crinoidic lmst.		shallow subtidal
LOWER CRETACEOUS	BERRIASIAN	80	oolithic lmst. marls, algal l.	gastropods	shallow subtidal to intertidal
		30	marls / cgl.	charophytes	fresh water
UPPER JURASSIC	PORTLANDIAN	150	dolomitic lmst. bioclastic lmst.	blue green al. gastropods	intertidal to supratidal
UPPER JURASSIC	KIMMERIDGIAN	300	bafflestone bioclastic lmst. alternating mudstones and micritic lmst.	coral stromatoporids ammonites	reef fore-reef pelagic
UPPER JURASSIC	OXFORDIAN	190		sponges	
			— iron crust	—	— non-deposition
MIDDLE JURASSIC	CALLOVIAN BATHONIAN	100	sandy lmst.	ammonites	deep subtidal
MIDDLE JURASSIC	BAJOCIAN	100	crinoid and coral lmst.	crinoids	shallow subtidal
MIDDLE JURASSIC	AALENIAN		sandy marls	ammonites	pelagic

lmst.: limestone cgl.: conglomerate

Fig. 2 - Simplified stratigraphic column of the Jura W of Geneva.

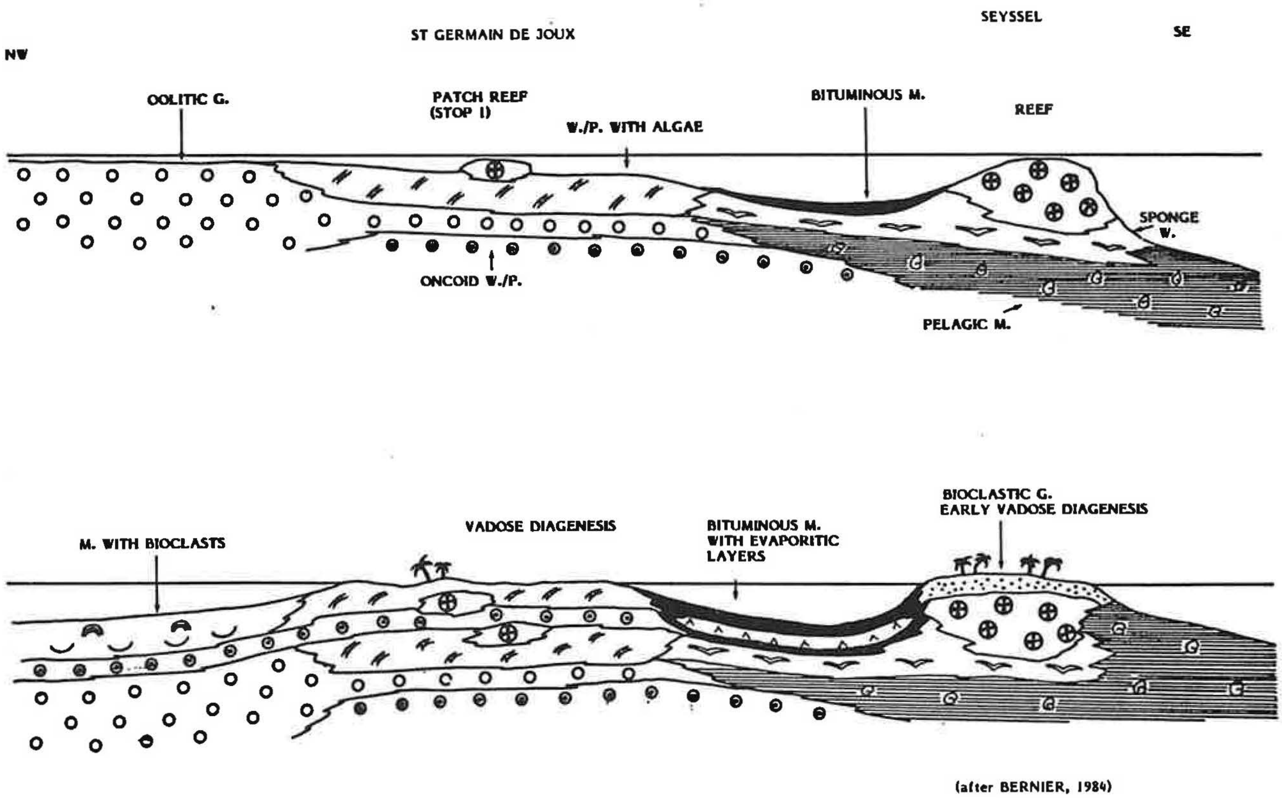


Fig. 3 - Evolution of the paleogeography during the Upper Kimmeridgian.

Fig. 3 sketches the paleogeographic evolution during the Late Jurassic and the development of typical shallow water facies.

STOP 1 : UPPER KIMMERIDGIAN OF ST. GERMAIN-DE-JOUX

The first outcrop visited is situated close to "Moulin de Prapont" (topographic map of France 1:25 000, Nantua 3229 est, coord. 248.500/5121.000). It shows well exposed reef buildups and a backreef sequence (fig. 4).

The section starts with bioturbated fine bioclastic packstones. Intensely dolomitised zones display high moldic and intergranular porosity. BERNIER (1983, p. 865-874) has observed that the dolomitised zones surround the bioconstructions. Based on geochemical (low Sr content) and petrographical[1] data he concludes that dolomitisation occurred in the fresh- and marine-water mixing zone (BADIOZAMANI 1973).

The basal part of the bioconstructions is a floatstone containing displaced branching and tabular corals. The bioconstructions themselves measure about 10 m in height and consist of massive branching corals and of stromatopores (bafflestone).[2]

Superposed are packstones with large bioclasts and gastropods, which pass quickly into stratified grainstones consisting of rolled bioclasts and ooids. In this high-energy facies bioconstructions of only a few meters in size developed. They are built up by branching and domal corals as well as by stromatopores.

Towards the top of the section, rolled and heavily bioeroded boulders (rudstone) of corals (branching and domal) and of stromatopores accumulated in a 1.5 m thick bed. The matrix is poorly sorted calcarenite. This deposit probably represents a tempestite and is comparable to subtidal storm deposits described by BALL et al. (1967) in the backreefs of Florida or to those accumulating on backreef beaches.

Following this rudstone is a planar-bedded calcarenite which in a closeby outcrop displays keystone vugs. These two features (bedding and vugs) are typical for beach deposits.

The uppermost part of the section is poorly exposed. However, we can observe a fine conglomerate with black pebbles (indicating erosion of pedological horizons: STRASSER & DAVAUD 1983) followed by dolomitic algal mats.

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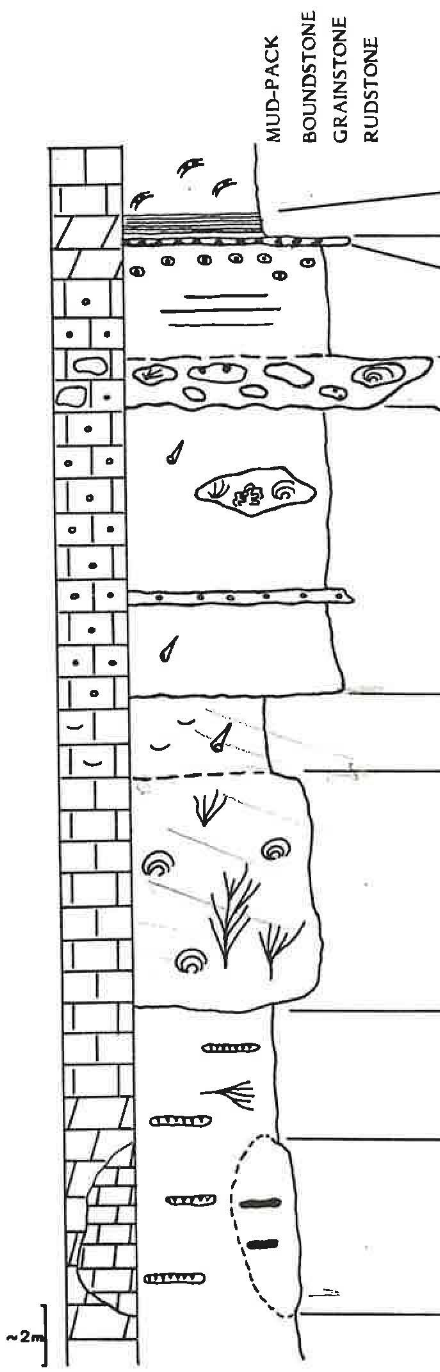
[1] Close to the strongly dolomitised zones syntaxial overgrowth precedes dolomitisation and suggests early, phreatic fresh-water cementation. Dissolution of aragonite shells supports this interpretation.

[2] The macro-organisms which can be found in the section have been studied by ENAY (1965), the microfauna by BERNIER (1983).



DESCRIPTION	INTERPRETATION
DACYCLADACEAN WACKSTONE	SHALLOW SUBTIDAL
DOLOMITIC LAMINATED MUDSTONE	SUPRATIDAL MUDFLAT
BLACK-PEBBLE CONGLOMERATE	EROSION OF PEDOGENIC LEVELS
THINLY LAMINATED GRAINSTONE (KEYSTONE VUGS AND PISOIDS NEAR THE TOP)	BEACH DEPOSITS
STROMATOPORID AND CORAL RUDSTONE. BOULDERS ARE MOSTLY BIOERODED	LOWER BEACH STORM DEPOSITS (?)
SMALL PATCH REEFS WITH STROMATOPORIDS MEANDERING/BRANCHING CORALS WELL ROUNDED BIOCLASTIC GRAINSTONE	SHALLOW SUBTIDAL ABOVE THE WAVE BASE
COARSE BIOCLASTIC PACKSTONE NERINEIDS	WIND PROTECTED AREA
STROMATOPORID AND CORAL (branching) BAFFLESTONE	PATCH REEF
FINE BIOCLASTIC PACKSTONE/FLOATSTONE SOME DISPLACED BRANCHING CORALS Plate like corals	REEF DESAGREGATION DEPOSITS (BELOW WAVE BASE)
STRONGLY DOLOMITISED SPOTS HIGH MOLDIC AND INTRAGRANULAR POROSITY	EARLY SELECTIVE DOLOMITISATION PROBABLY RELATED TO MIXING OF FRESH AND MARINE WATERS
FINE BIOCLASTIC PACKSTONE. TABULAR CORALS. BIOTURBATION SILICIFIED NODULES	

Fig. 4 - Upper Kimmeridgian section of St. Germain-de-Joux.

This passage from subtidal to supratidal thus represents a remarkable shallowing-upward sequence. The superposition of facies which are originally found next to each other (on the same topographic level) can only be achieved by the following two conditions:

1. Transgression or subsidence of the platform;
2. Strong sediment productivity compensating for the increasing water depth during transgression or subsidence.

STOP 2 : UPPER PORTLANDIAN OF CLUSE DE BART

The recently cut Rhone River canal (topographic map of France 1:25 000, Belley 7-8, coord. 247.370/5073.120) exposes Upper Jurassic and Lower Cretaceous strata (CHEVALLIER 1983). The Upper Portlandian is of particular interest as it features supratidal, intertidal and lagoonal sediments (fig. 5).

Supratidal environment:
The most dominant facies are dolomicrites which in many cases show algal laminations. Birdseyes are present. The sediment was fractured by desiccation, storms or springtides and produced flat pebbles. Pseudomorphs after gypsum, anhydrite or celestine occur in the upper part of the section and indicate hypersaline conditions. Black pebbles with root-traces and vadose cementation point to nearby subaerial exposure.

Intertidal environment:
Mudstones with birdseyes (which sometimes are aligned and concentrated in layers) have been deposited on an upper intertidal mudflat. Pebbles accumulated in channels. Some lagoonal packstones show birdseyes and were therefore exposed to intertidal conditions.

Subtidal environment:
Dasycladacean algae, miliolids and oncolites indicate shallow lagoonal environments which have been restricted to varying degrees.
Cross-bedded oolitic limestones are interpreted as migrating sand bars.

Two shallowing-upward sequences can be recognized; each one passes from oolitic to lagoonal to intertidal or supratidal facies. A possible setting leading to these sequences is shown in fig. 6.

The Portlandian series terminates in a perforated and corroded hardground and a tectonically overprinted zone of marls and reworked bored pebbles. While in closeby areas the sedimentation of Purbeckian fresh-water, intertidal and lagoonal limestones (up to 25 m) took place, Cluse de Bart was reigned by non-deposition.

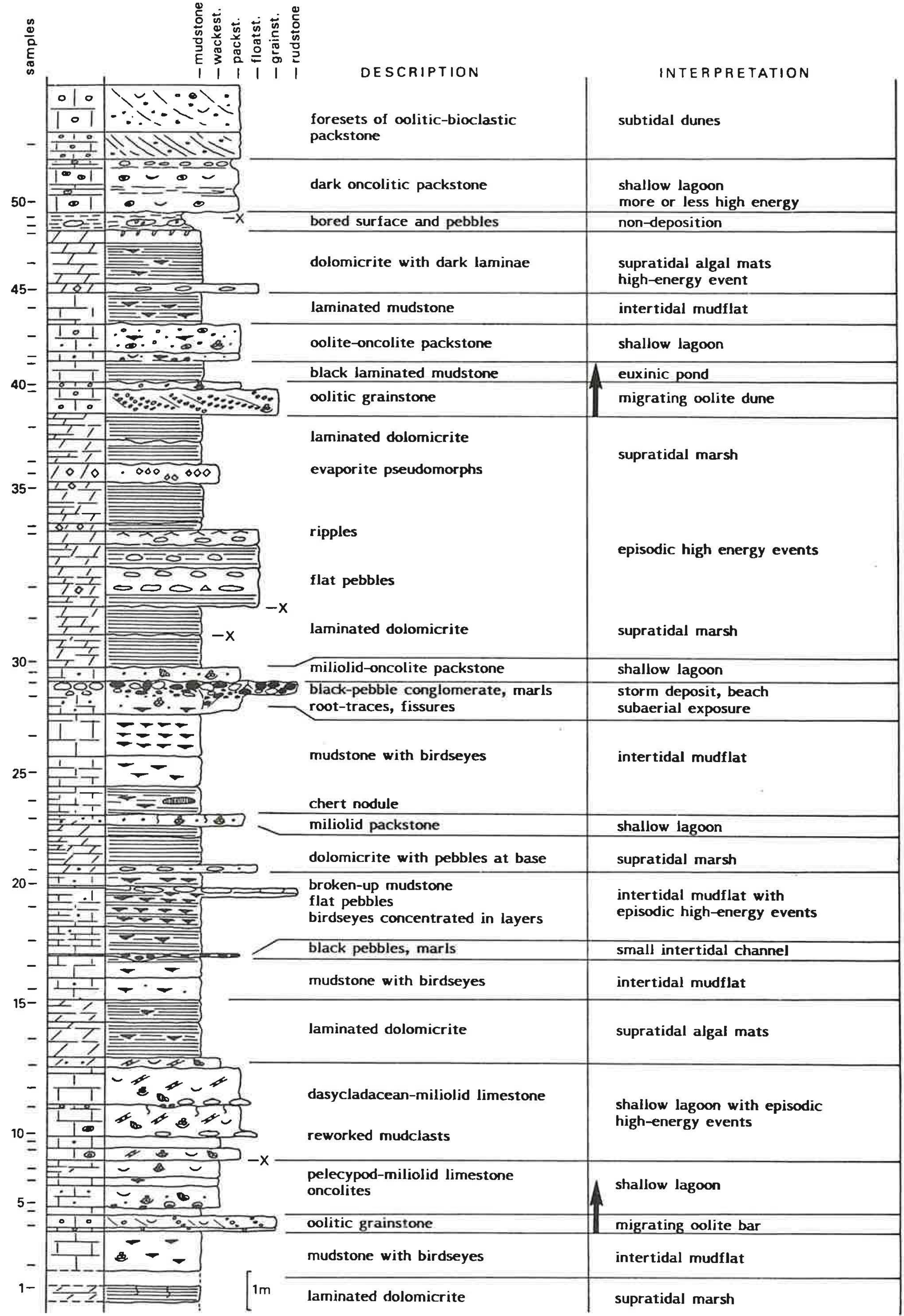


Fig. 5 - Upper Portlandian section of Cluse de Bart

The dark oncolitic packstones and the oolitic packstones with foresets at the top of the studied section represent the base of the Berriasian.

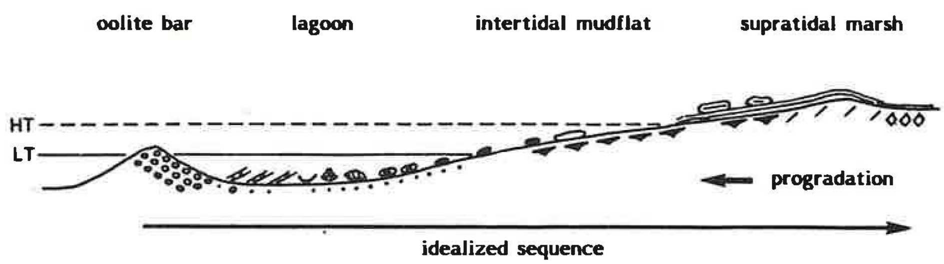


Fig. 6 - Hypothetical paleogeography during the Upper Portlandian.

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