

Projet Nerthe : Hommes et milieux

Responsable : Claude VELLA

Laboratoires : CEREGE, IFREMER,

- Modilisation et budget sédimentaire à l'Holocène dans la chaîne de la Nerthe
- Cartographie des morphologies sous-marines (paléovallée ennoyées, récifs de coralligènes) et sismique réflexion des remplissages sédimentaires
- Recherche d'un marqueur paléoclimatique ici les températures de l'eau de mer à partir des carbonates de l'espèce *Mésophyllum lichenoides*.
- Intégration des données archéologiques et stratigraphiques nouvelles : Vallon du pauvre Homme, Martigues.

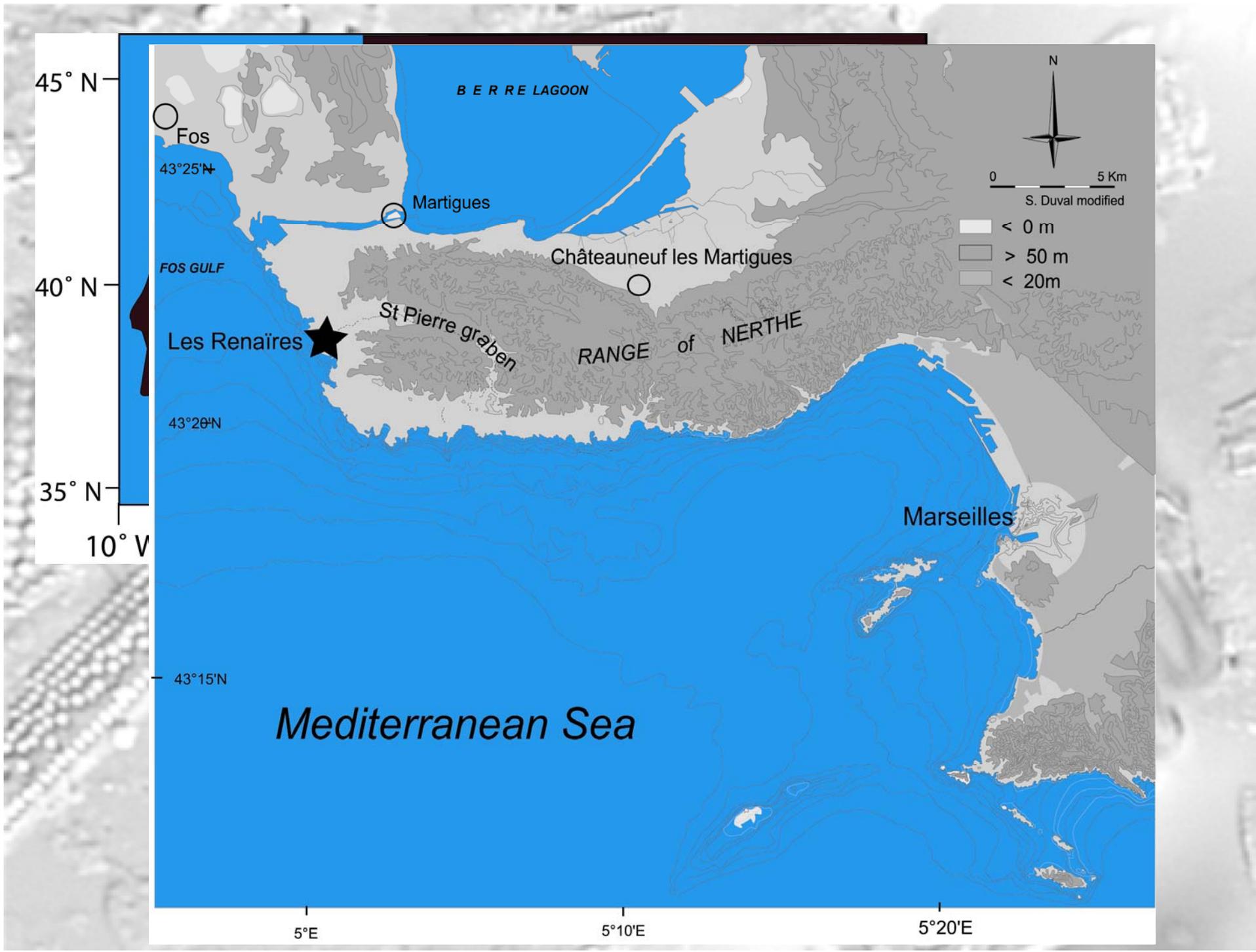
Erosion modelling & Sedimentary budget in an early anthropised watershed during the Holocene.

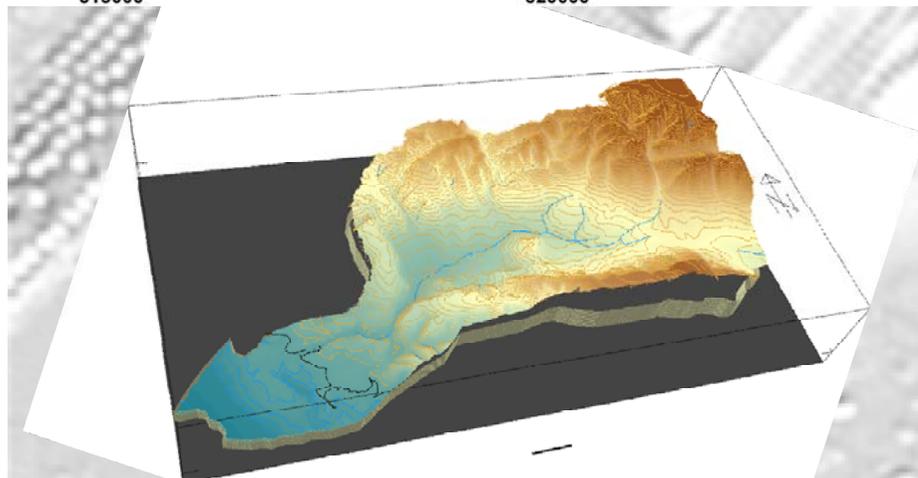
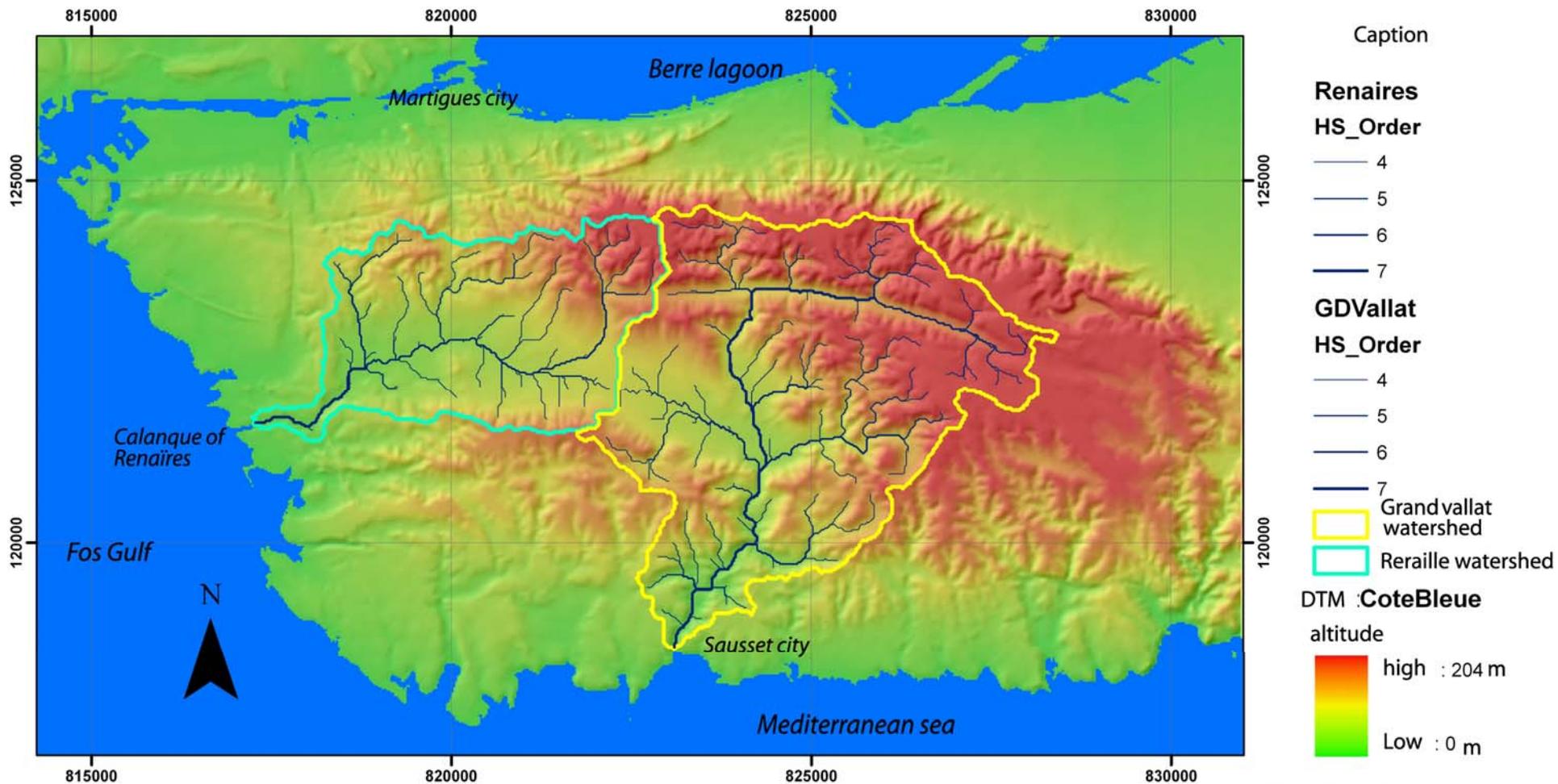
Quantify sedimentary fluxes

Separate the role of climatic and geomorphology forcings
from human impacts

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(¹CEREGE UMR6635 CNRS ; ²Martigues concil ; ³IRD)

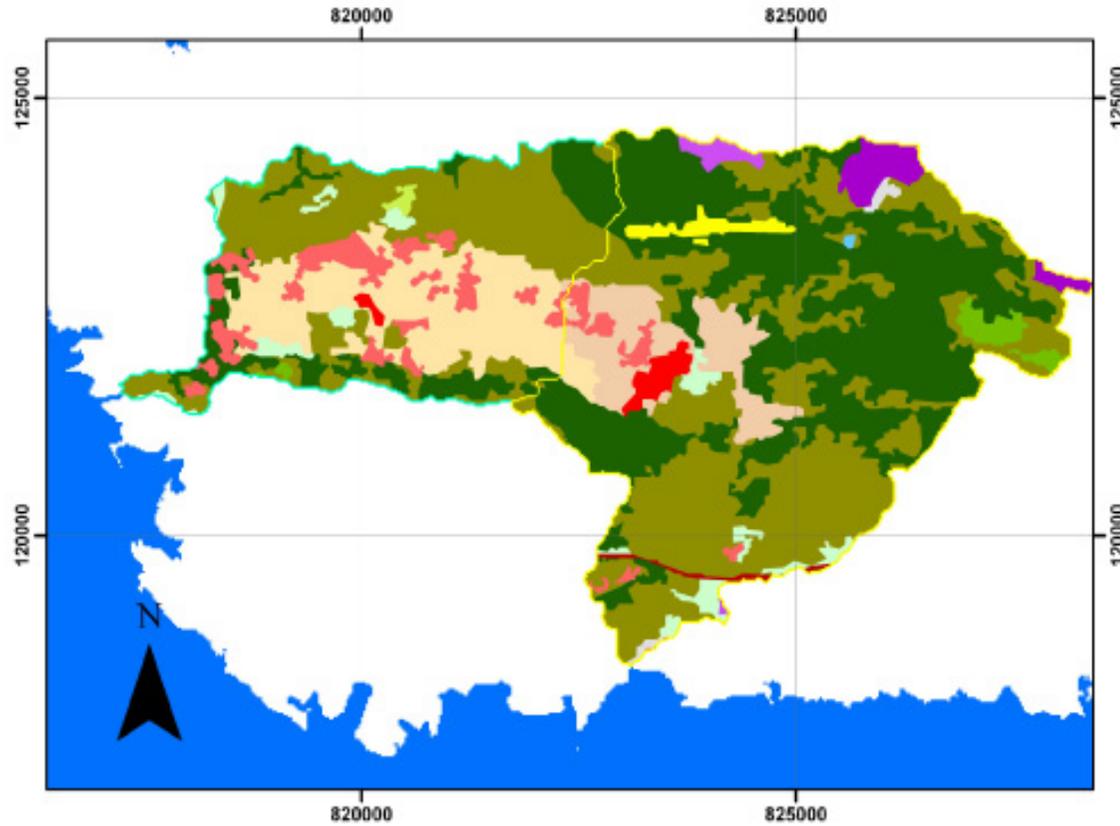




Reraille watershed = 11.7km²

Grand Vallat watershed = 21 km²

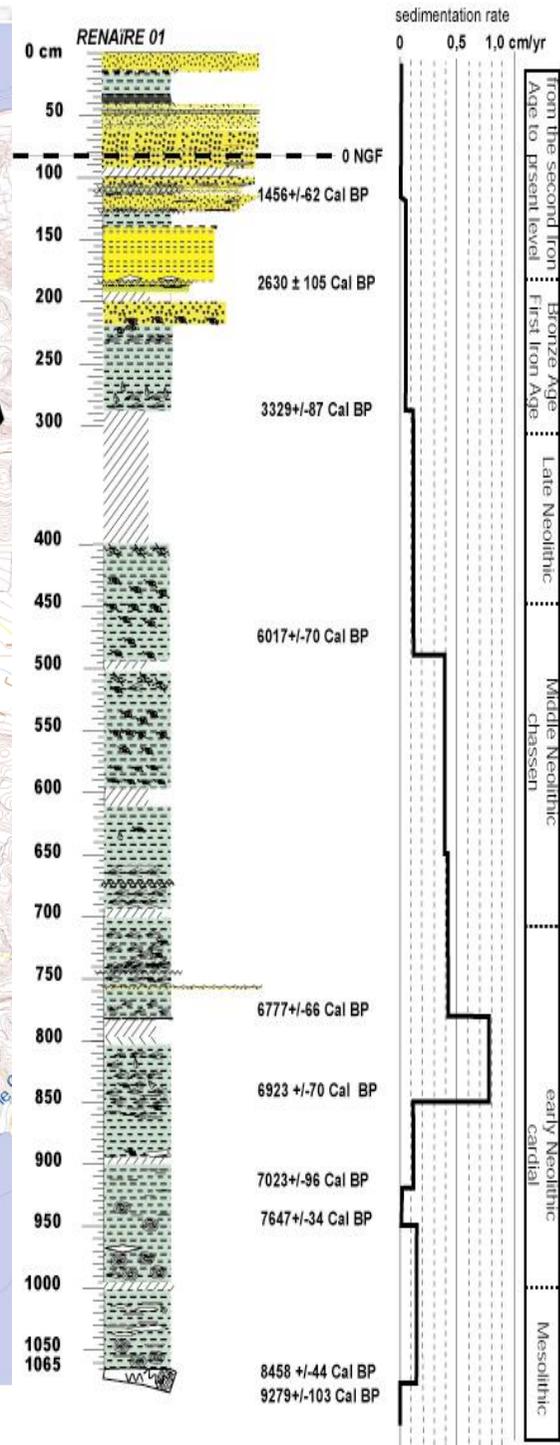
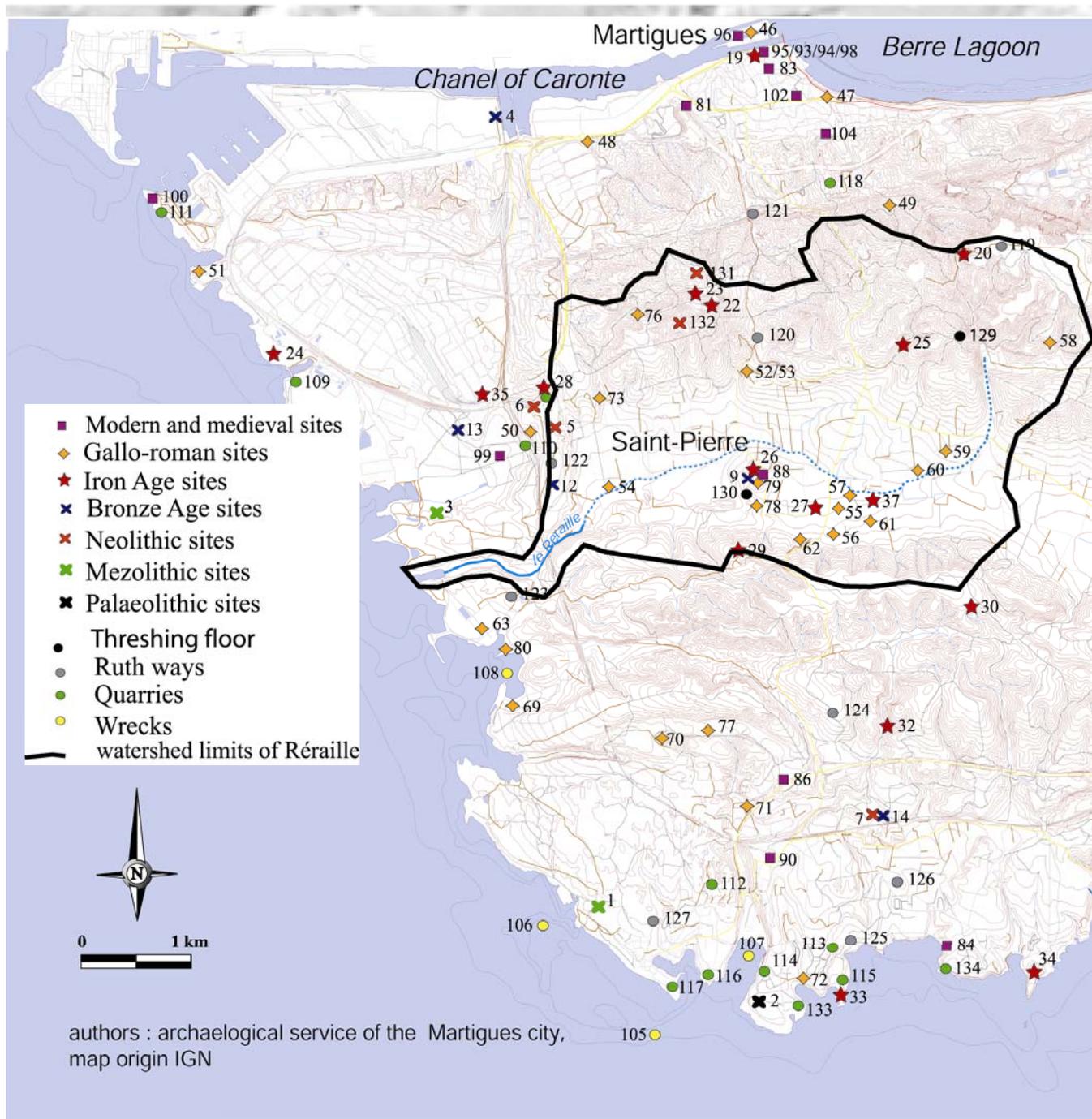
LANDCOVER Map



Caption

-  Urban area
-  Rural /residential area
-  Industrial & buisness areas
-  Roads & railways
-  Quarry
-  Non irragated arable land
-  Vineyards
-  Annual & permanent crops
-  pine trees
-  Grassland & natural pastures
-  Garrigue
-  Woodland & schrubs
-  rock otcrops
-  Scattered vegetation
-  water





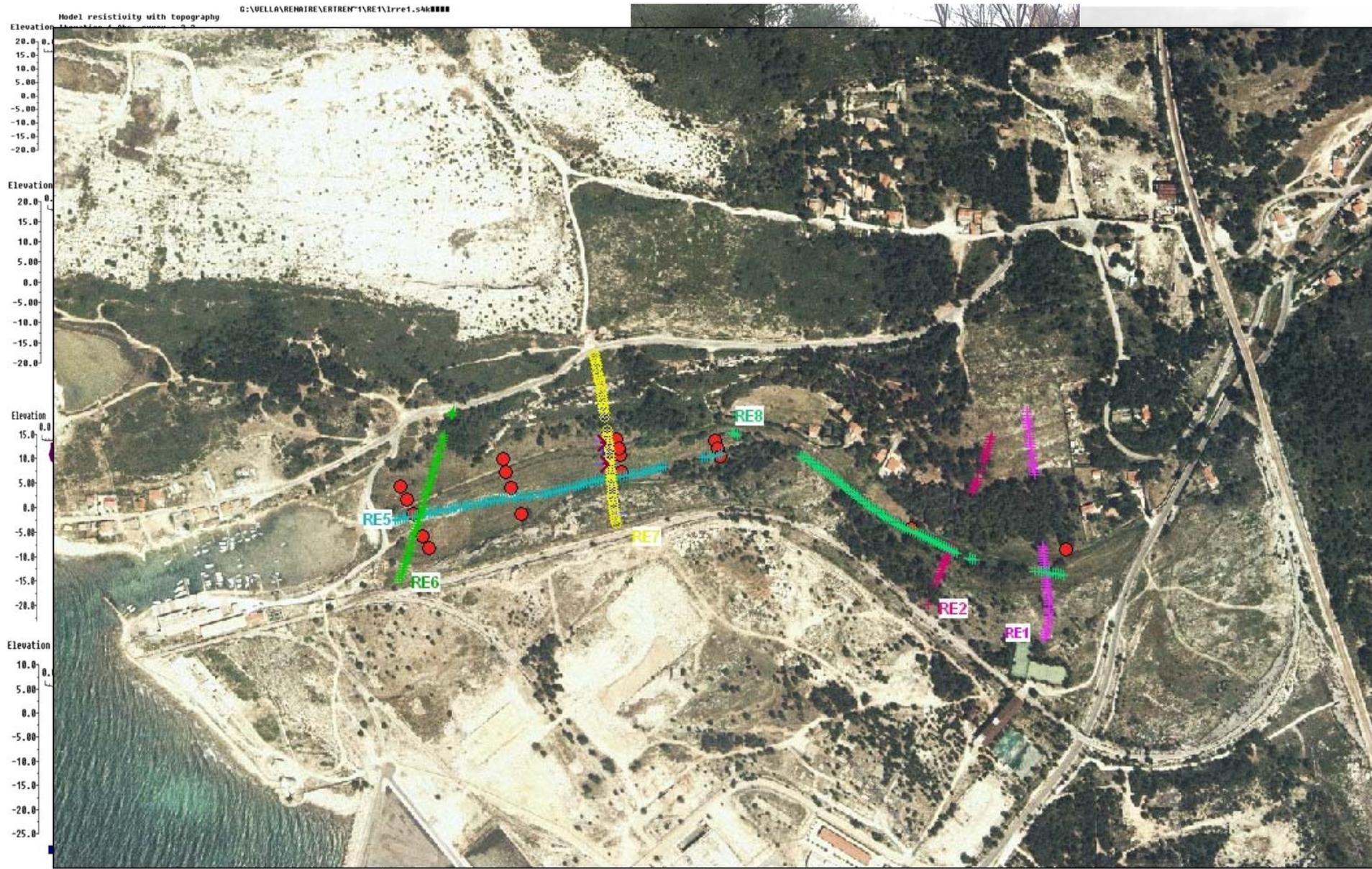
Archaeological sites in the watershed



Sedimentation rates in the upper catchment

Period	Volume in m ³	Sed.rate m ³ /yr
<i>Ante</i> Neolithic	8 600	1
Neolithic-Medieval	6 100	0.87
Post Medieval	3 000	3

Export ?

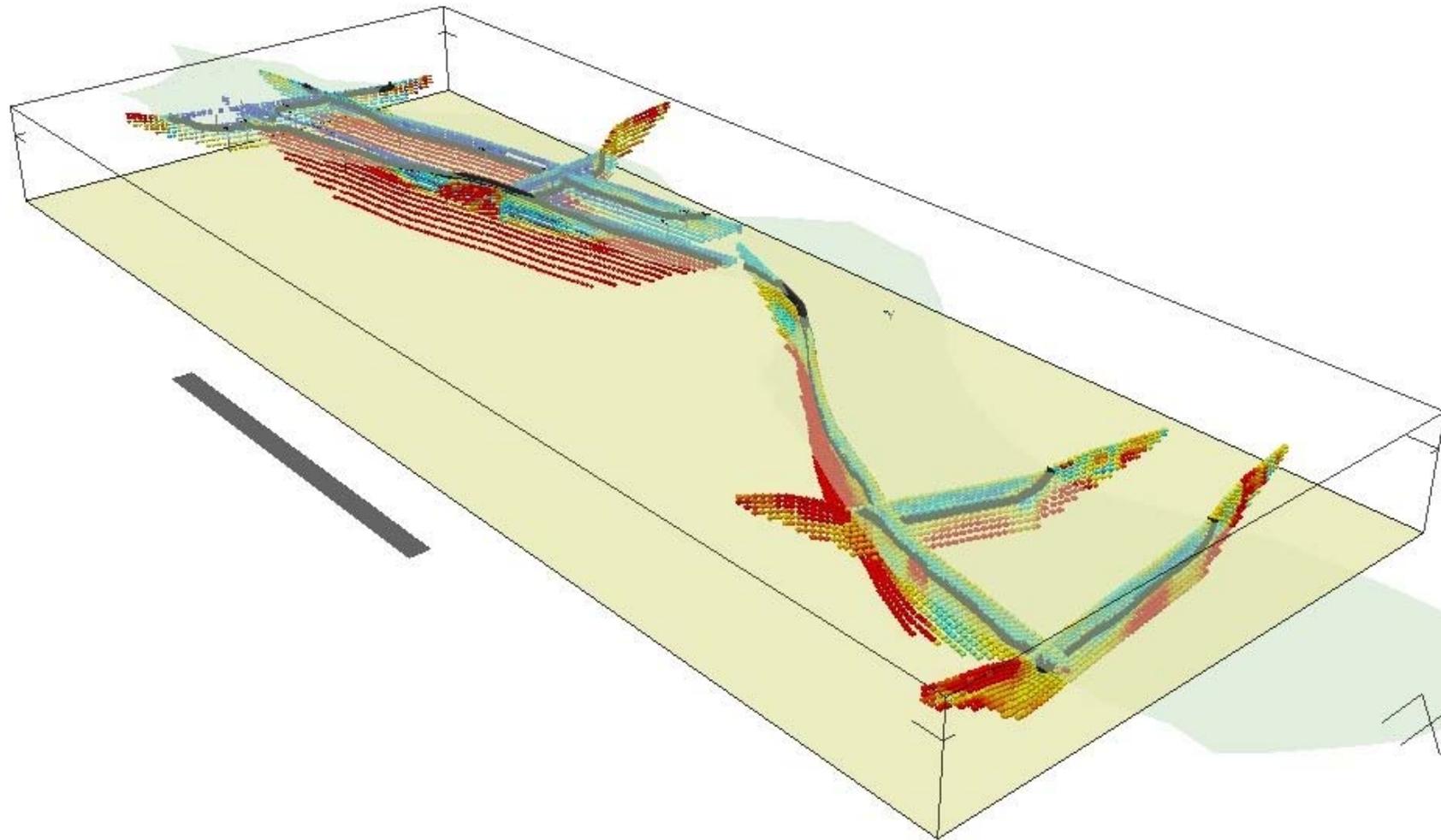


downstream



Horizontal scale is 7.40 pixels per unit spacing
Vertical exaggeration in model section display = 1.15
First electrode is located at 0.0 n.
Last electrode is located at 189.0 n.

High Resolution Electrical *Resistivity* Tomography (*ERT*)



Total volume deposit in the ria : 520 000 m³

Average rate of sedimentation since 8500 yr : 82 tons/yr

Watem / SEDEM model

Van Oost et al., 2000 ; Van Rompaey et al., 2001 ; Verstraeten et al., 2002

$$\text{RUSLE} : A = R * K * LS * C * P$$

(Renard et al. 1991)

LS : topographical factor

C : Cover management factor

P : Support practice factor

R: rainfall erosivity factor

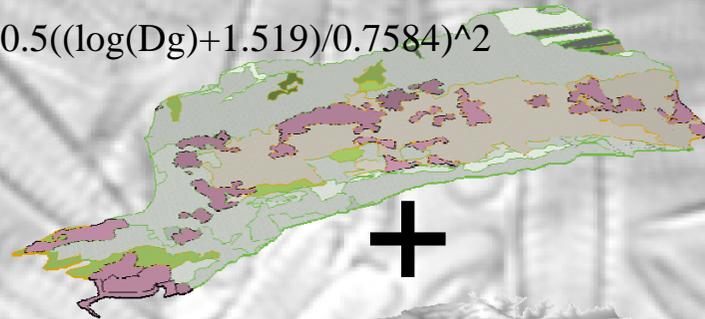
$$R = 0.04830 \cdot P^{1.610}$$

K: soil erodibility factor

$$K = 3.5 + 38.8e^{-0.5((\log(Dg) + 1.519)/0.7584)^2}$$

RUSLE Factor

+



+

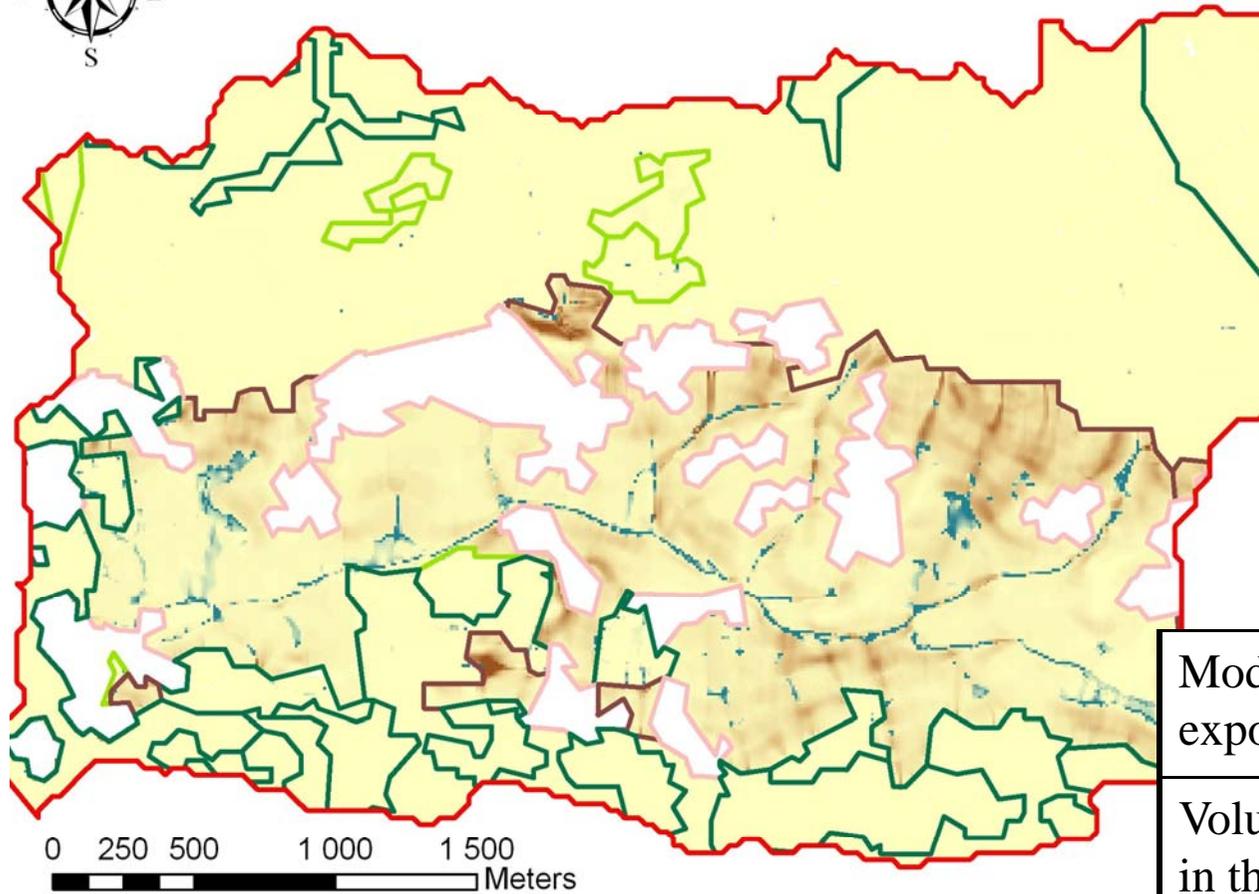
Land cover

- Forest
- Pasture
- annual crops
- streams
- urban and rural habitations

DTM

=

Ktc : Transport Capacity



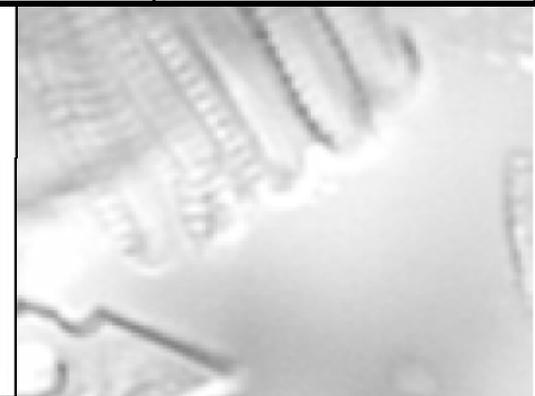
Sediment model repartition	Value in T/yr
Total sediment Production	13 163
Total sediment deposition	9 641
Total sediment export	3 522
Total river export to the ria	1 801

Model recent export	1 801 T/yr
Volume trapped in the ria	82 T/yr

Legend

- Model area
 - Catchment
- Soil occupation**
- build-up area
 - fields under agriculture
 - forest
 - pasture

Netto Water Erosion in ton per ha



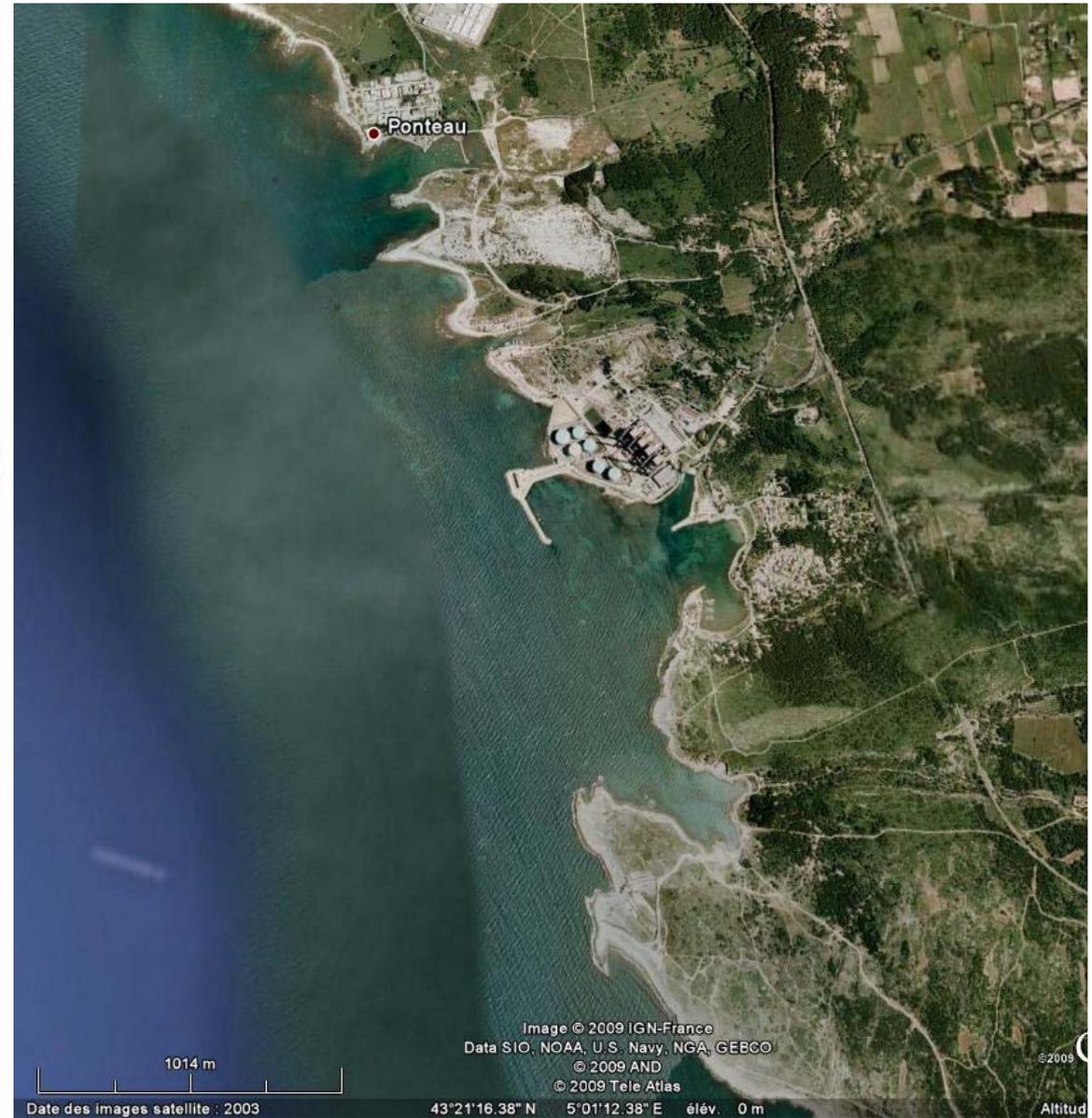
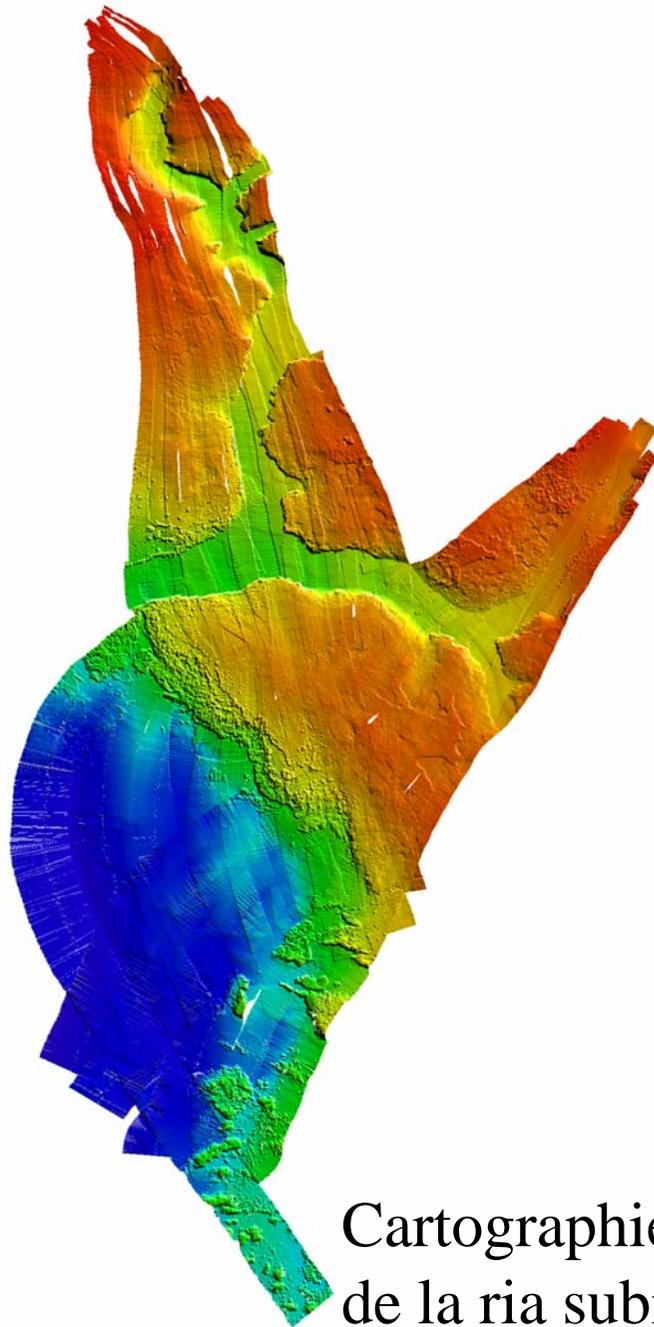
Conclusion

- WATEM-Sedem model in this case probably over-value sediment export to the ria because we use recent land cover map for modelled all the period of deposit. The model we will run with a new land cover map for each period from pollen analysis performed recently.
- The total sediment volume measured in the ria is consistent with the seize of the watershed.
- The scientific cruise of the Haliotis french boat of IFREMER in september 2009 will be map exportation in the open sea but the accumulation is probably weak.



30/08/09 au 30/09/09
scientific cruise of
Haliotis (IFREMER)

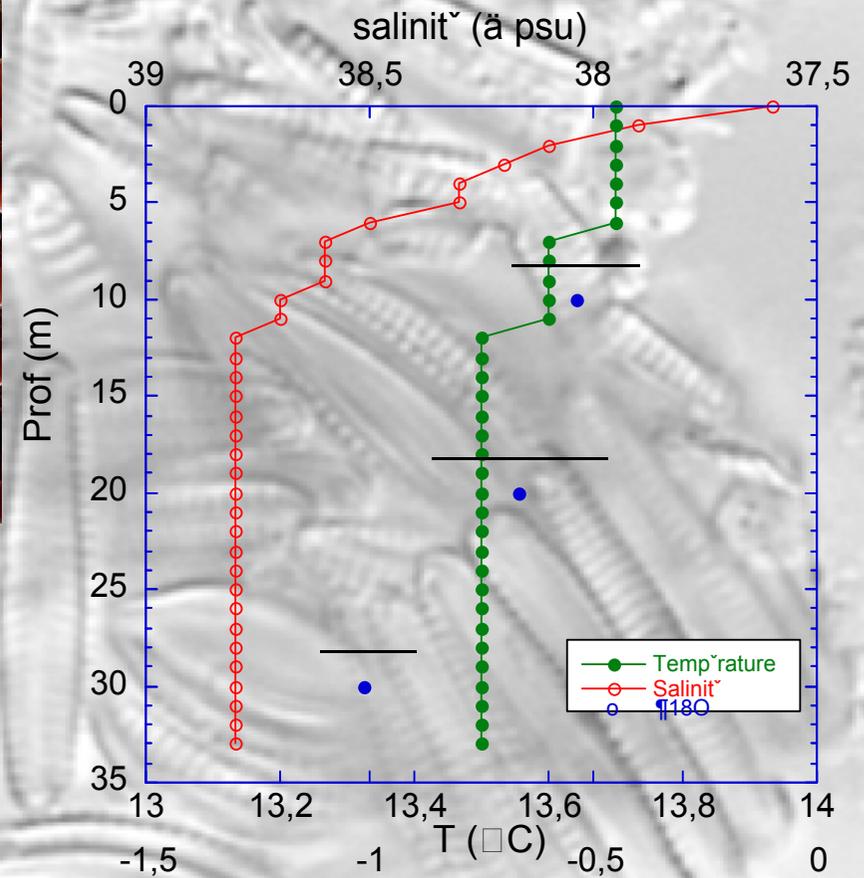




Cartographie bathymétrique et imagerie sonar, sismique de la ria submergée résultats de la mission Roustan2

Test sur le marqueur isotopique de l'oxygène à partir du *Mesophyllum lichenoïdes* actuel

La Ciotat Bec de l'Aigle (17/03/09)



DRX: 96.99% de calcite magnésienne à 13,8 % de Mg

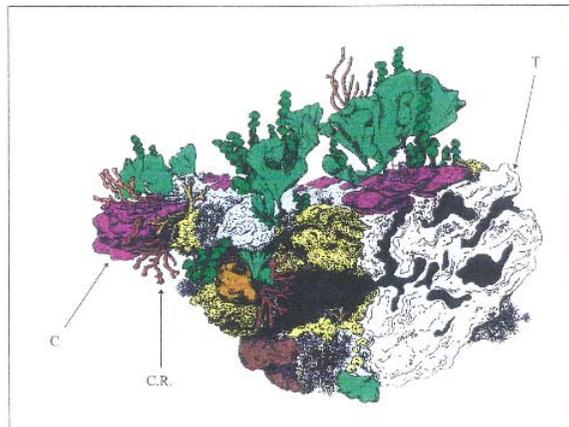


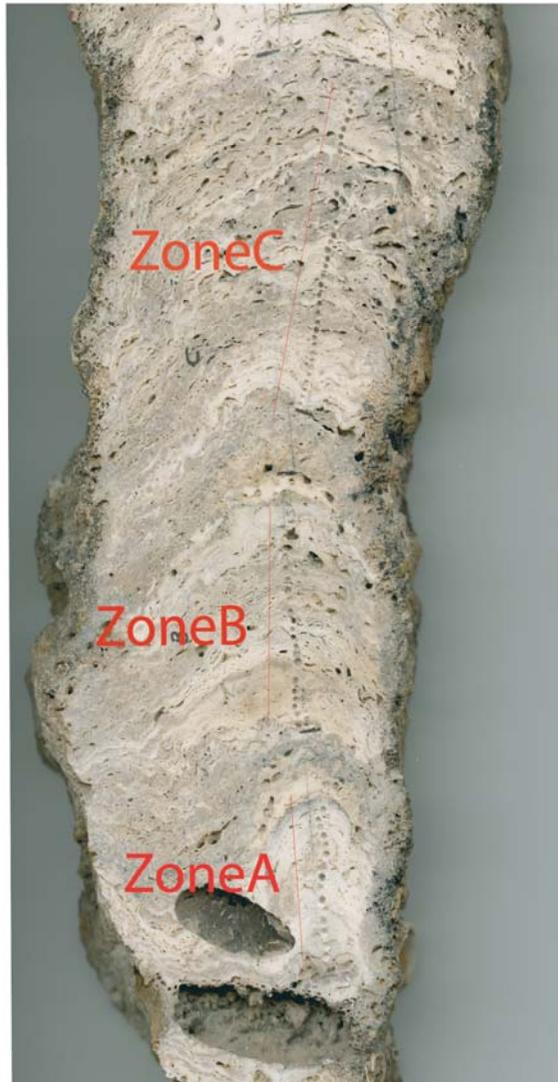
Figure 7. Aspect morphologique d'un encorbellement de Coralligène. T : trame algale, C.R. : *Corallium rubrum*, C : Corallinaceae. (d'après Natacha Müller, 1993).

(Sartoretto, 1996)

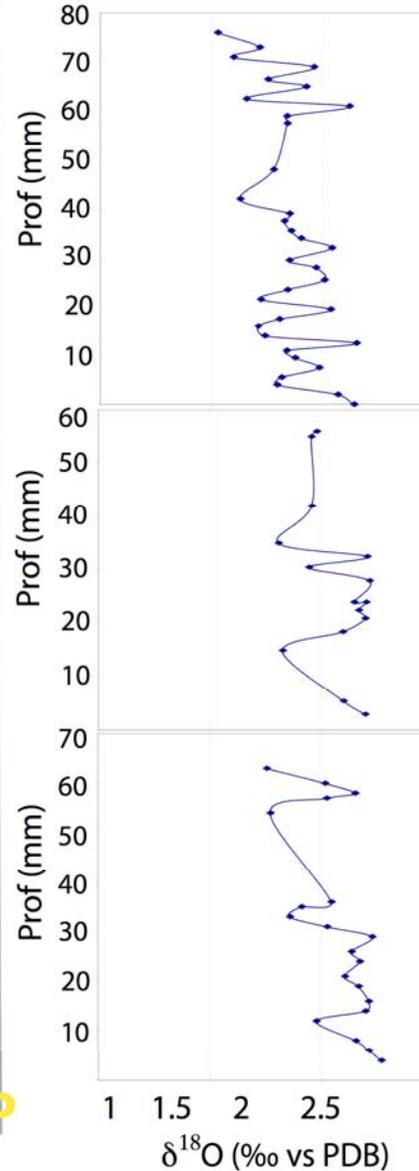
L'effet combiné de la diminution de la température et de la salinité devrait induire un delta 18O moins négatif

Mesophyllum lichenoides fossile

La Ciotat (9 m de profondeur)



Base 2510±120 ans BP
(Sartoretto, 1996)



Différences
entre
actuel et fossile

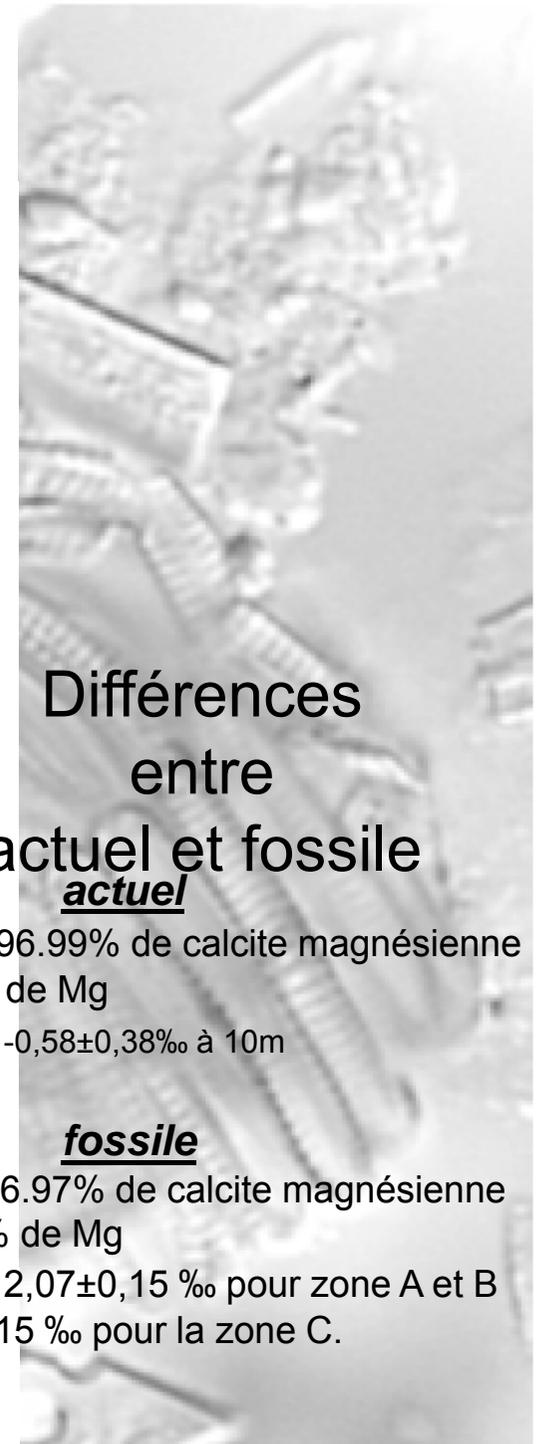
DRX: 96.99% de calcite magnésienne
à 13,8% de Mg

δ¹⁸O: -0,58±0,38‰ à 10m

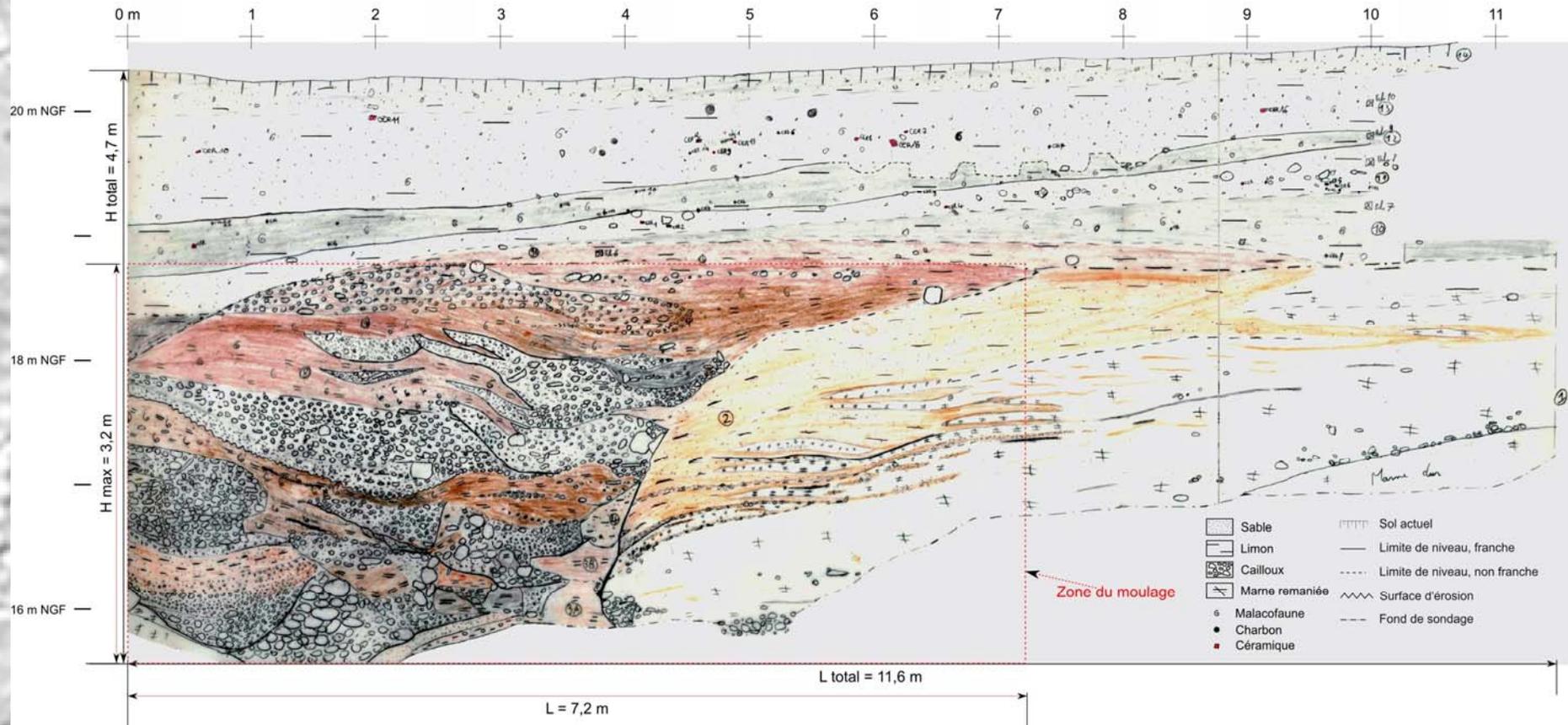
fossile

DRX: 96.97% de calcite magnésienne
À 12,1 % de Mg

δ¹⁸O: 2,07±0,15 ‰ pour zone A et B
1,86±0,15 ‰ pour la zone C.



Vallon du Pauvre Homme - Sondage 011
Coupe aval (sud)



Un enregistrement sédimentaire holocène exceptionnel



Contribution scientifiques depuis janvier 2009 :

- **Communication** à l'EGU en avril 2009 geoarchaeology session
- **Soumission** : Marine transgression in a Mediterranean ria during the Holocene Claude Vella, Christine Pailles, Victor Canut, Célia Beaudoin, Sandrine Duval, Jean Chausserie-Laprée, Michel Bourcier, Daniel Hermitte, Jean-Claude Parisot.
- **En préparation** : Erosion modelling & Sedimentary budget in an early anthropised watershed during the Holocene.
- **Projet ANR blanche NERTHE** : Natural ERosion and Territory Human Expansion