



	Experiment title: Alterations in fossilization process in teeth of small vertebrates by infrared spectrometry	Experiment number: EC792
Beamline: ID21	Date of experiment: from: 15 june 2011 (8am) to: 19 june 2011 (8am)	Date of report: 30 june 2011
Shifts: 12	Local contact(s): H. Castillo-Michel	<i>Received at ESRF:</i>
Names and affiliations of applicants (* indicates experimentalists): Hiram Castillo-Michel ID21 ESRF Y. Dauphin, UMR IDES, UPMC, Paris, France B. Farre, UMR IDES, Université Paris sud, France C.T. Williams, Natural History Museum, London, UK		

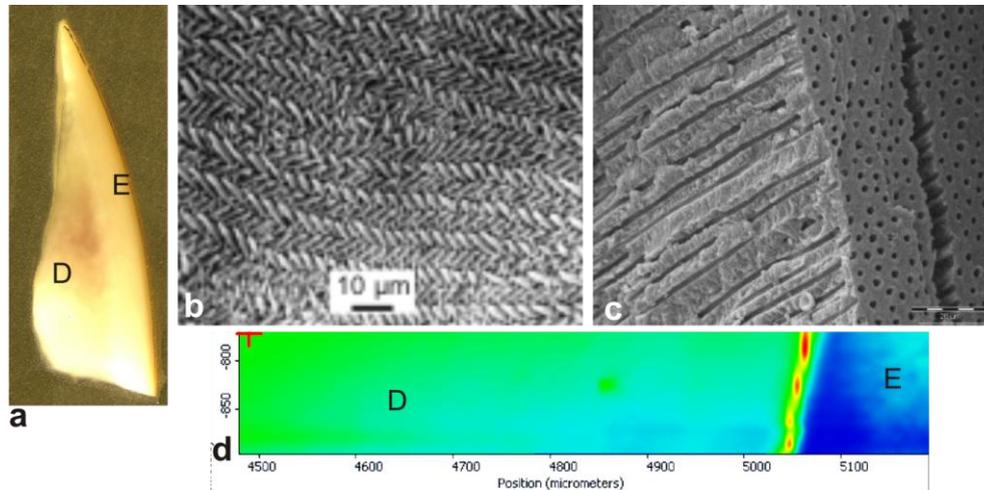
Report:

A “long term” three-step study was planned to identify alteration processes occurring during fossilization in teeth of small vertebrates (Rodents). First, modern fresh teeth of Rodents will be studied to build a set of references for the mineralogy, organo-mineral ratios, crystallinity, fluor contents of enamel and dentine in molars and ever-growing incisors. Then, modern teeth extracted from regurgitation pellets or carnivore faeces will be studied to estimate the changes induced by the digestion of the predator. At last, fossil teeth from archaeological sites in Morocco will be analysed. Changes in crystallinity and organo-mineral ratios... will be determined using FTIR maps and spectra, then will be compared with microstructural changes (SEM and AFM), changes in the bulk organo-mineral contents (laser confocal UV and fluorescence), and elemental chemical composition modifications (electron microprobes). Additionally, the composition of the enamel and dentine will be compared with that of the sediment.

This experiment was dedicated to the first stage: studies of fresh teeth. Incisors from wild animals (*Meriones*) and a breed one (*Rattus rattus*) were selected. Molars have complex morphology, depending of the individual age of the animal, so that identification of dentine and enamel is not easy on these small samples. On the opposite, the geometry of incisor is simple, and enamel is present only along a side of the tooth. Moreover, incisors are not used for systematic determination of the species of rodent, because of their simple geometry. Molars are very useful for that purpose, so that they are preserved, whereas incisors can be “destroyed” (included in resin, cut and polished). To avoid biases due to the peculiar growth of these teeth, only the tips were prepared.

Previous electron microprobe analyses had shown that teeth and bones of wild animals are more mineralized than those of breed animals. Thus, teeth extracted from wild animals are more suited for a comparison with fossil samples. However, because FTIR is also able to provide data on cristallinity, organic matrix..., we have included a *Rattus* to detect potential biases in these criteria.

Large maps have been done in the tips, to detect the differences between enamel and dentine, and to observe the Enamel – Dentine Junction (EDJ). Enamel is usually composed of a thin outer layer, and a thick inner layer the structure of which depends on the species. Dentine shows numerous parallel tubules. EDJ is a thin zone, rich in organic components. The dentine along the EDJ is usually more organic than the main part. Detailed maps of dentine on one hand, and enamel on the other hand, have been performed.



a-Polished section of the tip of a *Meriones* incisor used for FTIR maps; b- monoserial enamel; c- parallel tubules of the dentine; d- untreated map of a “phosphate band” showing the difference between the outer enamel, the inner dentine and the thin transition zone rich in organic matrix.

All the maps were successful, despite the runs were long (> 8 hours).

Detailed analyses of the maps for specific bands will be done in the next months, to quantify crystallinity, organic – mineral ratios, F and Sr contents... In such small teeth (maximal thickness < 2 mm), localized analyses are the only way to have data on the enamel on one hand, and dentine on the other hand. Observation of the mapped zones will be done using scanning electron microscopy, epifluorescence and confocal microscopy. All these observations will be used in future manuscripts.

These analyses of these fresh modern samples will be used as references for the future analyses and comparison of modern teeth extracted from bird of prey regurgitation pellets from the same geographical region. Then, fossil teeth from the same species, collected in the same region, will be examined to estimate the preservation state.

Teeth have been collected thanks to a French ANR grant (MOHMIE, 6è extinction). Results of the experiment have been shown at the annual meeting of the ANR project (June 2011). Some confocal microscope observations have been done.