

INFRARED SPECTROSCOPY OF PLIO-QUATERNARY SEDIMENTS, FROM LIMA RIVER BASIN AND ALVARÃES BASIN (PORTUGAL).

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Introduction

This paper purposes to study gibbsite and kaolinite crystallinity, present in Plio-quadernary fluvial sediments and in a colluvium (12A.PL.2), from Lima river basin and Alvarães basin, Minho region, Portugal NW. Firstly was collected the $<2\mu\text{m}$ fraction, and studied by X-ray diffraction, using $\text{CuK}\alpha$; that allow mineral identification, gibbsite and kaolinite like chiefly minerals, in ratio varying from almost pure gibbsitic to kaolinitic materials. The infrared spectroscopy was recorded in percent transmission over the range 4000 to 400cm^{-1} , from pressed discs of samples dispersed in KBr, and in percent absorption over the range 4000 to 2500cm^{-1} , from muller samples (previously 105°C heated) with fluoroluble and mounted on NaCl crystal. The transmission spectra shows mineral associations and impurities. The gibbsite and kaolinite crystallinity was qualitatively appreciated on stretching O-H region of absorption spectra, because on high frequencies the absorption bands of this minerals are independents and on the remaining low frequencies there is interferences and parcial superposition that affects mainly the kaolinite crystallinity index.

Results

The spectroscopy spectra recorded, fig.1 and 2, mainly the absorption spectra, shows on O-H stretching region absorption bands in 3620 , 3525 and 3450cm^{-1} diagnostics of gibbsite mineral. This bands are presents in almost spectra, except in more kaolinitic samples (15.ALV.5 and 3.CAR.1), and most of them are followed by 3395 and 3375cm^{-1} tipic doublet bands of well crystallized gibbsite (table 1); in 15.ALV.14, 25.VC.3 and 8B.PL.3 samples this doublet is reduced to only one in 3380cm^{-1} region. The sample 4.PL.1 is the more gibbsitic one and have a very similar spectra to the MOENKE (1963) gibbsite, with kaolinite vestiges, quartz (1170cm^{-1}) and anátase (1400cm^{-1}) impurities. Again O-H stretching region shows absorption bands in 3700 and 3620cm^{-1} region characteristic of kaolinite mineral group in general. This bands are very marked on percent absorption spectra, in 15.ALV.5 and 3.CAR.1 samples they are very intense, and vestigials in 4.PL.1 and 5.PL.2. Therefore, the doublet in 3670 and 3650 region (table 1), kaolinite crystallinity indicator, is visible in almost kaolinites; 12A.PL.2 and 19.PL.1 samples presents only a little 3650cm^{-1} band, the first sample showing a smooth shoulder in 3670cm^{-1} region. Among kaolinitic samples group, the 15.ALV.5 and 3.CAR.1 spectra are very similar to Dry Branch (USA) kaolinite (VAN DER MAREL

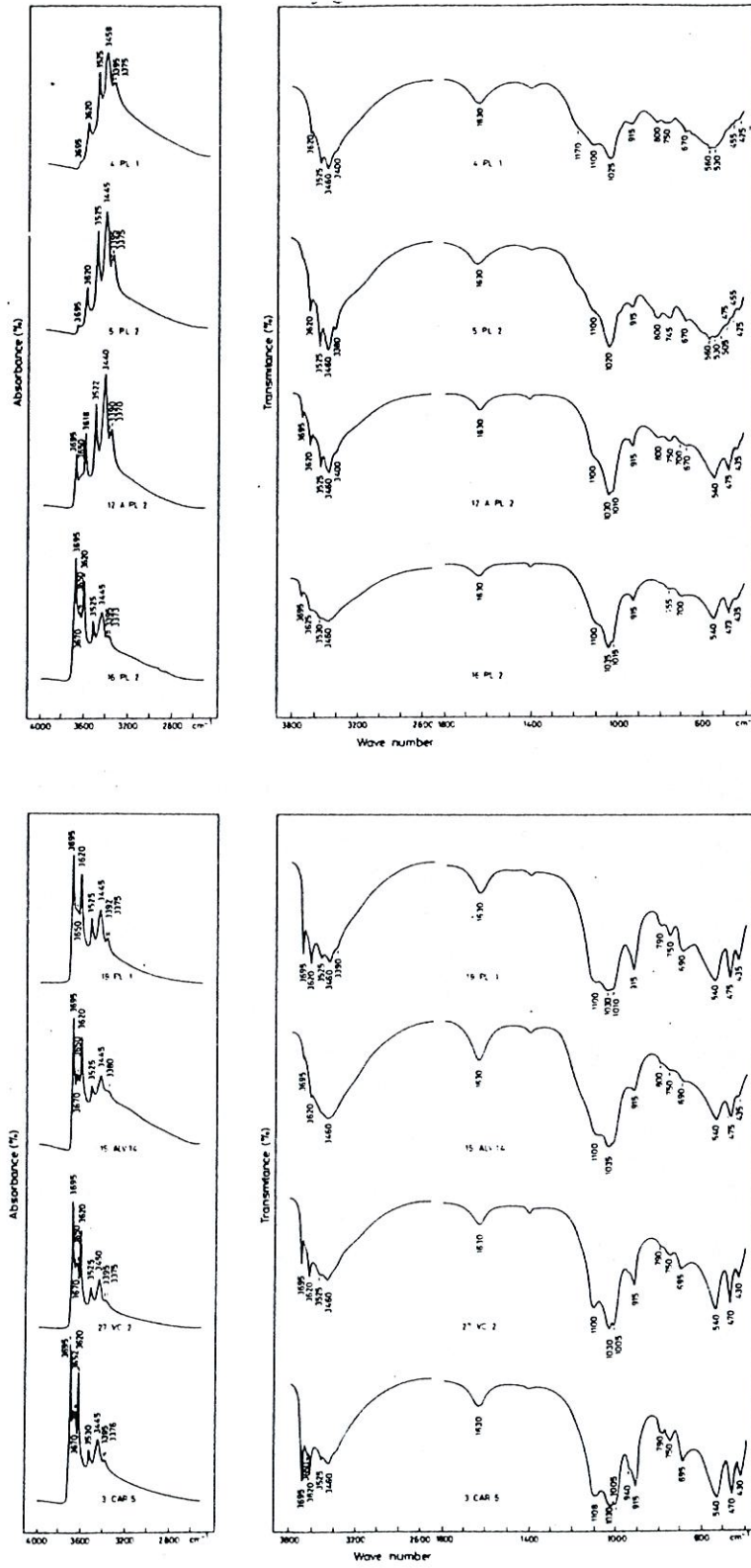


Fig. 1 - Infrared spectra of <2μm fluvial sediments and colluvium (12A.PL.2)

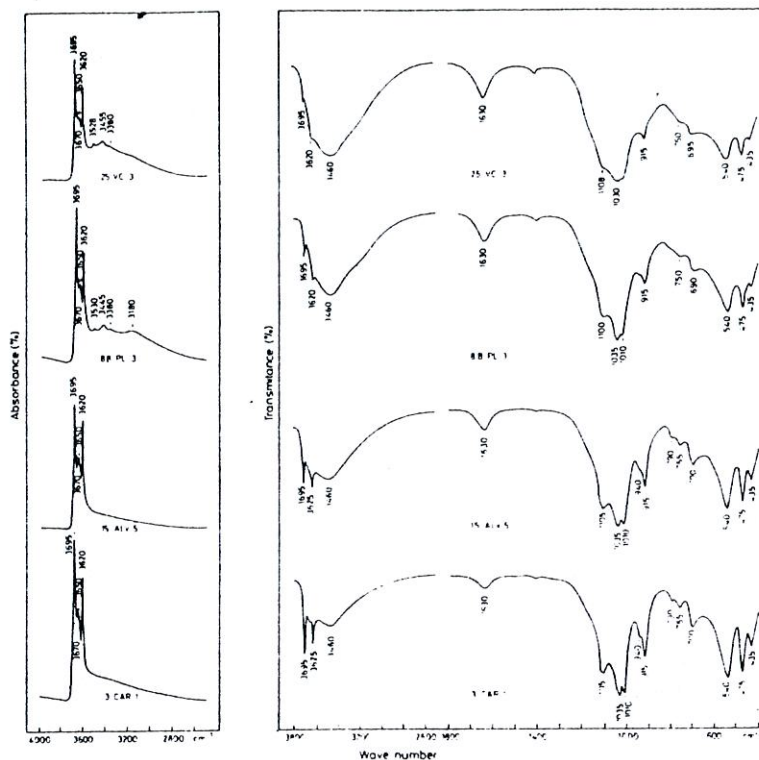


Fig.2 - Infrared spectra of <2 μ m fluvial sediments

and BEUTELSPACHER 1976), 19.PL.1 spectra similar to disordered kaolinite Frantex B (WILSON 1987) and 12A.PL.2 spectra seems correspond to an intermediate crystallised kaolinite between this two types, and it is similar to the Provence (France) deposit kaolinite (VAN DER MAREL and BEUTELSPACHER 1976).

The structural disorder may be observed by 3670 cm^{-1} band absorption diminution with progressive increase of 3650 cm^{-1} band, and this make possible group the samples like this: better crystallized kaolinites 3.CAR.1 and 15.ALV.5 samples, followed in decreasing crystallinity order 15.ALV.14, 3.CAR.5, 27.VC.2, 8B.PL.2, 25.VC.3, 16.PL.2, 12A.PL.2 and 19.PL.1 (disordered kaolinite). In 15.ALV.14, 25.VC.3 e 8B.PL.3 samples we don't see individualized the gibbsite mineral doublet in 3395 and 3375 cm^{-1} region; in the other samples, except in pure kaolinites, this doublet appears with resembling interval.

Table 1 - Absorption bands (cm^{-1}) frequencies in O-H stretching region, on percent absorption spectra.

4.PL.1	5.PL.2	12A.PL.2	16.PL.2	19.PL.1	15.ALV.14
3695	3695	3695	3695	3695	3695
			3670		3670
		3650	3650	3650	3650
3620	3620	3618	3620	3620	3620
3525	3525	3522	3525	3525	3525
3458	3445	3440	3445	3445	3445
3395	3395	3390	3395	3392	
3375	3375	3370	3373	3375	3380
			3220		
			3155		
27.VC.2	3.CAR.5	25.VC.3	8B.PL.3	15.ALV.5	3.CAR.1
3695	3695	3695	3695	3695	3695
3670	3670	3670	3670	3670	3670
3650	3652	3650	3650	3650	3650
3620	3620	3620	3620	3620	3620
3525	3530	3528	3530		
3450	3445	3455	3445		
3395	3395				
3375	3376	3380	3380		
			3180		

Conclusions

The infrared spectra shows that in the studied sediments gibbsite have a high crystallinity grade. In this sediments the greater number of kaolinites shows, on absorption spectra, 3670 and 3650 cm^{-1} bands, characteristic of well crystallized kaolinites, however, we observe ever in the better crystallized ones that the intensity of low frequency band 3650 cm^{-1} is greater than the 3670 cm^{-1} intensity, meaning that exist some structural disorder in this minerals. kaolinite crystallinity seems be greater in samples without gibbsite (15.ALV.5 and 3.CAR.1), and the others have intermediate indexes between those and the more disorder kaolinite, 19.PL.1 sample. In the percent transmission spectra there are absorption bands of water molecules (3460 and 1630 cm^{-1}), probably KBr discs absorbed, and like impurities anatase (1400 cm^{-1}), goethite (3155 cm^{-1} in 16.PL.2 sample and 3180 cm^{-1} in 8B.PL.3 sample), some quartz (1170 cm^{-1}) and perhaps illite-vermiculite interstratified (3220 cm^{-1} in 16.PL.2 sample).

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