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MAJOR AND TRACE ELEMENTS IN GEOLOGICAL SAMPLES FROM ITINGUSSÚ BASIN IN COROA-GRANDE, R J.

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ABSTRACT

The goal of the present work was to characterize soil samples and sediment of mangrove belong the Itingussú river drainage basin, with a view to investigate the lithological signature of it. This small drainage ends in area not yet largely impacted by other sources such as industrial and domestic waste in relation to the elements studied here. The results showed some enrichment of the U,Th and some light rare earth elements in the Itingussú sediment sample. This represent the leucocratic rock signature, according to the normalized of data by upper crustal mean values .

1. INTRODUCTION

The Itingussú drainage basin is situated in Coroa-Grande district, Sepetiba Bay, south of Rio de Janeiro. It belongs to Rio Negro Complex, a granitic pre-cambrian embasement. It is a small bay of drainage that ends in a mangrove that extends from Itacuruçá to Coroa-Grande. The local soil is not well developed, classified between cambissol and latossol (DE MELLO,1993).

In a previous study of the lithology of the Itingussú basin rock samples were classified as dioritic quartz, tonalitic gnaisse, leuco-granitic, quartz-dioritic gnaisse, granodioritic gnaisse and leuco-tonalitic (ARARIPE et al., 2004). It was found high content of thorium and light rare earth in the leucocratic rocks. In the present paper results of the concentration of 20 inorganic elements in soil samples and a sediment core are reported. Normalization of total data matrix was performed to investigate the signature of soil and mangrove sediments.

2. METHODOLOGY

2.1. Sample Collection

Soil samples were collected from road side profile in the drainage. The sampling sites of soil and sediment core from mangrove ecosystem are depicted in figure 1. The mineralogy of the soil samples were classified as saprolites, and haloalterites.

2.2. Sample preparation

The samples were sieved to a 2 mm, and separated from roots and sand. Afterwards the samples were powered and quarted for the chemical determination by instrumental neutron activation analysis (INAA) using the comparative method. In this work it was used three standards: the Red-Clay PODMORE, from the University Research Reactor (URR- England); Soil7, from International Atomic Energy Agency and; the Standard Reference Material 2704 (Búfalo River Sediment), from National Institute of Standard Bureau.

2.3. Irradiation

Each sample and standard weighed around 200 mg. The samples and standards were irradiated at the IEA-R1 reactor of IPEN with a neutron flux of 10^{13} $n.cm^{-2}.s^{-1}$. For short-lived radionuclides the samples and standards were irradiated during 1.5 minutes with a time count of 4 minutes. For long-lived radionuclides the irradiation time was 8 h with a count time of 5400 sec after 10 days of cooling time.

2.4. Counting system and data reduction

The irradiated samples were counted in a ORTEC´s high purity Ge detector (GeHP), and also in CAMBERRA´s low energy photon detector (GAMX), the resolution for the 1332.5 kev gamma ray of ^{60}Co was 2.8 keV and 1.8 keV respectively.
The gamma spectra were analysed with the GRGAN code;, this programme allow to choose the background of each peak, which was specially selected (GILMORE,1983; LATINI,2000; idem, 2001) and, at the end of the analysis it gives the results in elemental concentration.

3. RESULTS AND DISCUSSION

The results presented in tables 1 and 2 are the arithmetic means from sub samples (1-2 cm) of the sediment core, and a total soil samples.As mentioned before the results from our previous work on rocks were also used for comparison.

The normalization graphic (figure 2) was based in Condie values (Condie, 1996). It can be seen an enrichment of light rare earth elements (ETRL) and thorium in soil and sediment, probably due to the contribution of leucocratic rocks to these sediments. Although these rocks are not enriched in uranium, the soil and sediment samples were indeed enriched. Probably the accessory minerals and oceanic water are responsible for this enrichment. The Hf fallows closely Zr in the zircon mineral. As the mineral zircon is very resistant for chemical weathering processes probably the Hf anomaly is provoked by the presence of the resistant mineral “Zircon”. Unfortunately we do not have analyzed Zr in our samples due to the limitation of our method employed in this work.

Significant correlations can be seen (table 3) for the ETRL and the fraction of minor than 63μm in the sediment core. Unfortunately there was no correlation with hafnium, uranium and grain sizes. In the > 63μm grain size fraction, it is expected the presence of heavy minerals such as titanite, zircon etc. and sand grains are probably responsible for this non-correlation behavior.

4. CONCLUSIONS

It was found in this work that the analyzed soil samples as well as the sediment sample from the mangrove area of Itingussú basin, have much higher chemical concentration to the ETRL, Th, U and Hf, than in the local rock samples. One explanation, is the influence of a physical transport of detritus composed of zircon minerals, probably by alluvial transport, that can be enriched with hafnium and uranium and caused a matrix dillution of the others immoble elements like scandium and titanium. Another factor is the presence of acessory minerals that contain ETRL, Th and some U, like allanite and apatite. The element U can be supply by marine water, too. In the future work, we plan to collect more sediment samples to have better knowedlege of the distribution of these elements and their mobility, according to the type of sediment (more arenous or more argillaceous) and others parameters not observed in this work.

Table 1 – Concentrations of Major elements of geological samples (%)

	Rock[1]	sd	soil	sd	sediment	sd
Na	2,513	1,062	0,1194	0,0633	1,326	0,125
Mg	0,9563	0,9409	0,9192	0,3387	0,9730	0,1579
Al	9,692	2,198	9,642	1,934	5,678	0,732
Fe	3,900	3,301	6,327	5,217	2,055	0,374

1- ARARIPE ET AL, 2004.

Table 2 – Concentrations of Trace elements of geological samples (μg/g)

	Rock[1]	sd[2]	soil	sd	sediment	sd
Ba	610,6	551,9	552,5	241,0	621,4	57,0
Rb	113,3	81,4	142,3	49,6	113,2	9,1
La	44,65	56,74	50,02	18,82	51,45	22,28
Ce	91,53	112,5	88,21	50,30	105,6	37,7
Nd	23,81	20,41	na	-	46,63	16,00
Sm	6,179	3,941	14,18	7,81	8,798	3,033
Eu	1,501	0,579	2,542	1,703	1,078	0,130
Lu	0,1645	0,1637	0,4633	0,3252	0,2231	0,0788
Th	14,97	21,35	15,20	10,14	20,56	9,49
U	2,490	3,538	4,187	2,983	6,565	2,093
V	97,75	119,7	164,5	194,3	42,71	19,27
Sc	10,54	8,73	18,70	14,82	7,373	1,347
Cr	30,00	44,35	64,76	61,31	27,64	3,89
Co	13,85	13,74	22,47	20,25	6,407	1,012
Hf	4,894	5,721	8,940	3,669	16,72	7,48
Ti	5642	5391	10009	12007	2883	801

1 - ARARIPE ET AL, 2004; 2 – standard desviation ; 3 - na = no analysed

Table 3 – Values of Significative Pearson correlation ofof Trace elements of Sediment from Itingussú (N=13; r =0,473; P=5%)

Elemento	<63µm
Al	-
Ba	-
Ca	-
Ce	0,49
Co	-
Cr	-
Cs	-
Dy	-
Eu	0,61
Fe	-
Hf	-
La	0,53
Lu	-
Mn	-
Na	-
Nd	0,51
Rb	-
Sc	-
Sm	(0,45)
Th	-
Ti	-
U	-
V	-
Yb	-

(-) no significative values

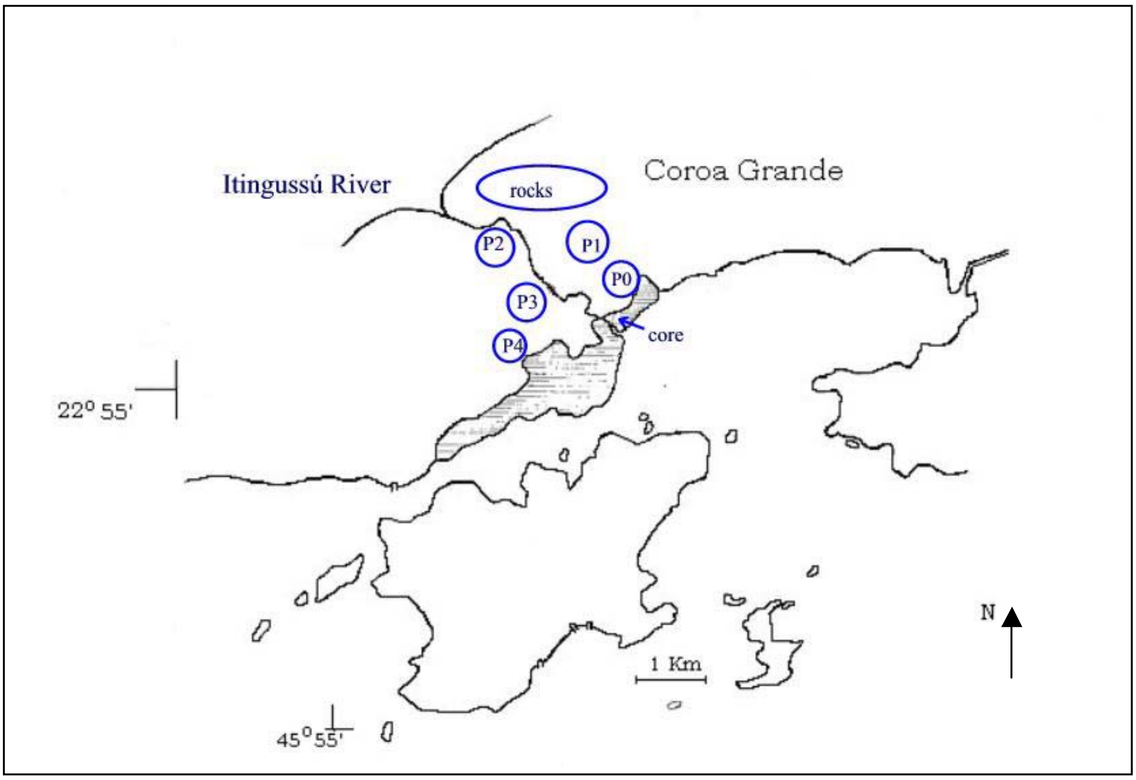

Figure 1- Drainage basin of Itingussú River and sites of samples ;P*n* – sites of soil samples ; Rocks – area of rock samples; Core – area of sediment core from mangrove

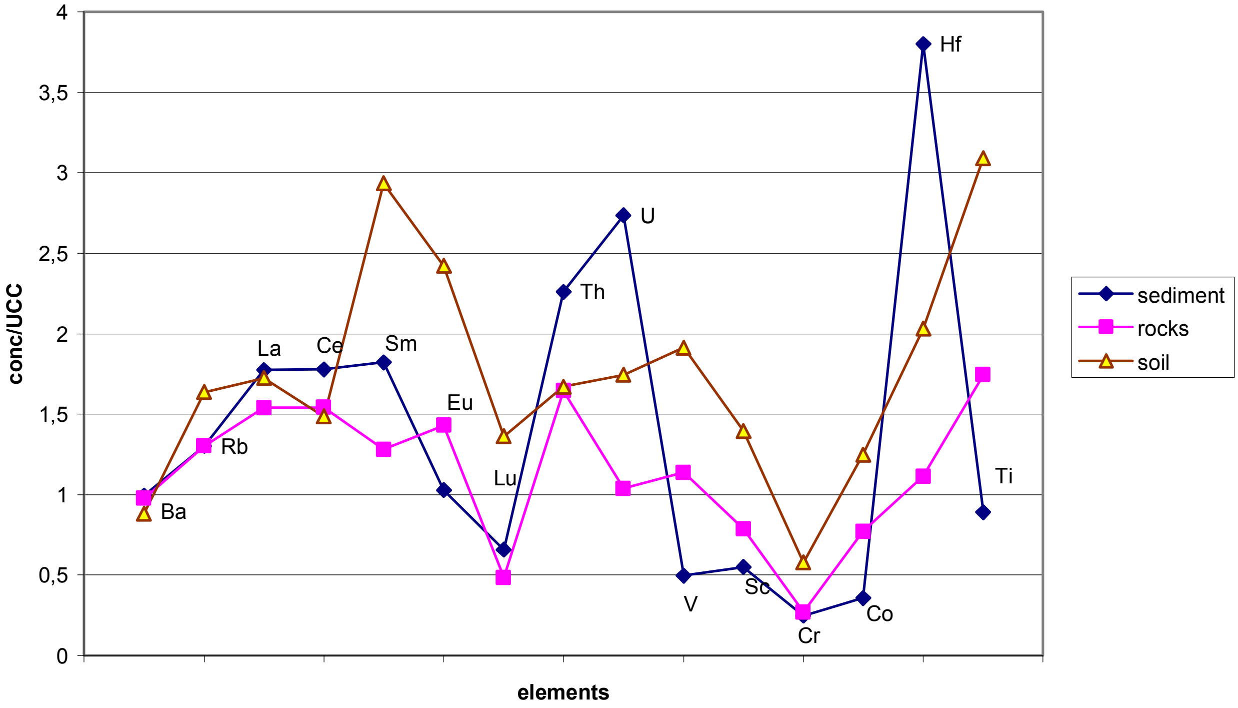

Figure 2 – Normalization graphic based in values for Upper Continental Crust (Condie, 1996)

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