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Abstracts

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THE GEOCHEMISTRY OF ALBITIZATION AND RELATED U-MINERALIZATION, ESPINHARAS, PB, BRAZIL.

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The radioactive uraniferous deposit of Espinharas is situated in the northeast Brazilian shield. The U-mineralization is related to sodium metasomatism and episyenitization of amphibolite facies, gneisses and intrusive micrograinites.

Two major well-defined groups of gneisses occur: granitic leucocratic gneisses and mesocratic, biotite-amphibolite gneisses. The former ones are considered orthogneisses and the latter, paragenic in origin. The gneisses are of old Precambrian, lower Proterozoic or, even more probably, of Archean age. Granitic and mesocratic gneisses are associated with sub-concordant structural relationships. The intrusive microgranites cut the gneisses as dikes of metric to decametric width and very variable extension (metric to kilometric). The microgranites are hololeucocratic and their age is most probably upper Proterozoic, though age determinations are inexistent for that specific area.

The uraniferous mineralizations are included in albitized and episyenitized rock portions that occur in a zone discordant of the high grade metamorphic regional foliation. This zone resulted from shearing stresses and fraturing that controlled first the intrusions of microgranites and, later, the percolation of the metasomatic mineralizing fluids along widened grain boundaries and microfractures. All the three major rock types: granitic gneisses mesocratic gneisses and intrusive microgranites were affected. Dimensions and forms of the resulting metasomatized rock portions and the occurrence of higher grade uraniferous mineralizations depended additionally on the primary rock compositions (general mineralogical and chemical controls) and of the pre-existing regional foliations (structural/textural anisotropies only in gneisses).

The particular local geological situation forwarded undoubtedly correlate rock pairs and complete transition series of the above mentioned three major lithologies, including non-metasomatic and mineralized equivalents.

The qualitative and quantitative mineralogical and major chemical and trace element data are shown in tabs. 1 and 2.

Mineralogically, the main metasomatic processes resulted always in: (I) complete dissolution of quartz; (II) albitization of both: plagioclase and microcline; (III) chloritization and partial dissolution of biotite; (IV) precipitation of: coffinite, pyrite, chlorite, albite and carbonates frequently associated with minerals of Y and REE (xenotyme), partially filling the voids resulting from quartz dissolution. In the special case of the mesocratic biotite-amphibole gneisses there occurred, in addition, the precipitation of blue riebeckitic amphiboles epitactically overgrown on the primary ones (tab. 1).

Table 1 – Qualitative and quantitative mineralogical composition of non-metasomatic rocks. (1) granitic gneisses, (2) microgranite and (3) mesocratic, biotite-amphibole gneisses, from Espinharas.

Minerals vol %	(1)	(2)	(3)
Microcline	48	43	–
Plagioclase	20	22	38
Quartz	21	28	22
Biotite	8	3	17
Amphibole	–	–	17
Titanite	1	<1	2
Apatite	<1	<1	<1
Opaque ore minerals	<1	<1	<1
Muscovite	<1	<1	2
Chlorite	<1	<1	–
Epidote	<1	<1	<1
Clinozoisite	<1	<1	<1
Leucoxenite	<1	<1	–
Calcite	–	<1	<1
Sericite	<1	<1	5
	–	–	

The chemistry of major and trace elements further sustains the above mentioned processes and shows, in addition, important migrations in the trace element spectra (tab. 2).

For the purposes of geochemical exploration and ore genesis, it was important to identify elements that could safely correlate mineralized and non-mineralized parent rocks and characterize the mineralizing fluids. However, with the aid of the common main trace elements this was not always possible beyond doubt (tab. 2). Therefore, REE's were included in the studies. Fig. 1 shows mean REE distribution patterns (chondrite normalized) of non-metasomatical and mineralized equivalents of the three major rock types. It becomes evident that the light and intermediate REE precisely define the relationships of parent and mineralized rocks. U-mineralization goes along with a very characteristic enrichment of heavy REE's, Dy to Lu.

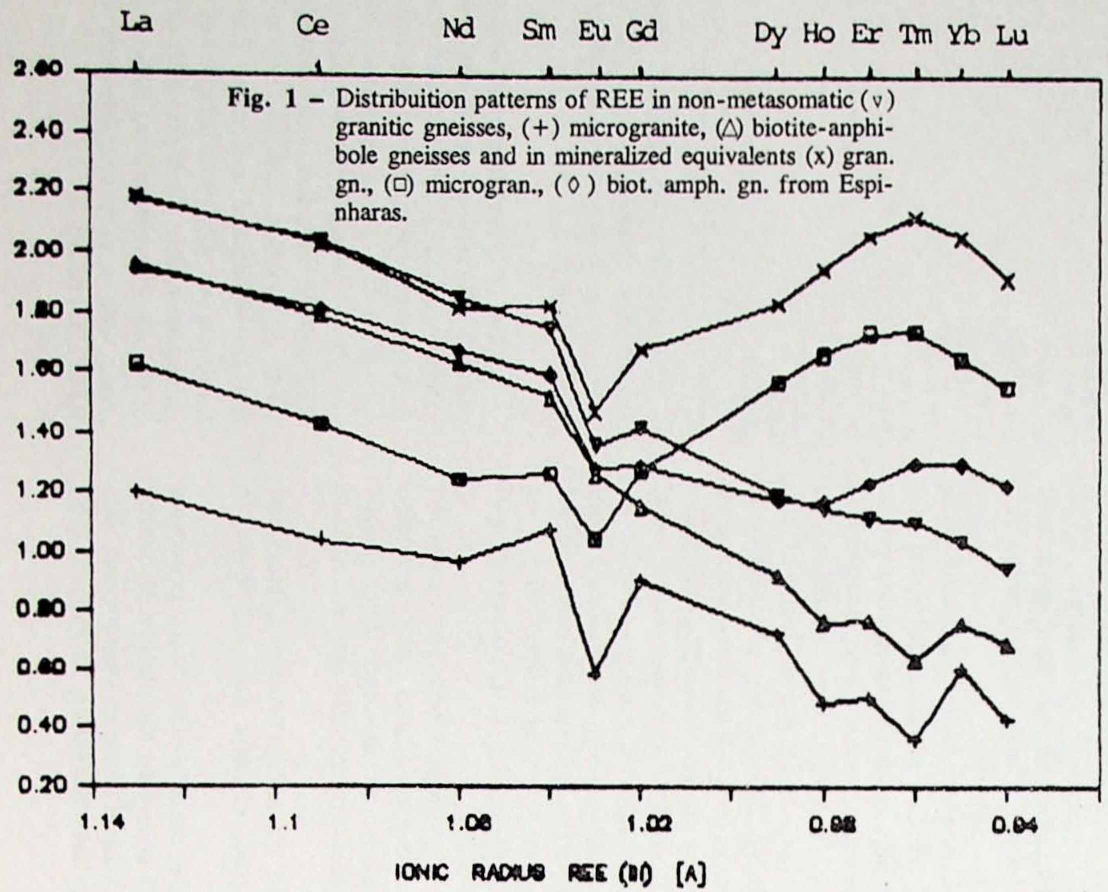

Fig. 1 – Distribuition patterns of REE in non-metasomatic (v) granitic gneisses, (+) microgranite, (△) biotite-anphibole gneisses and in mineralized equivalents (x) gran. gn., (□) microgran., (◇) biot. amph. gn. from Espinharas.

Table 2 –Major and trace element characteristcs of. (1) granitic gneises, (2) microgranit and (3) mesocratic, biotite amphibole gneisses; (A) non-metasomatic and (B) metasomatic and mineralized equivalents rocks from Espinharas (XRF and ICP–AES analyses).

wt. %	1		2		3	
Elements	**A**	**B**	**A**	**B**	**A**	**B**
S_1O_2	71.10	62.20	75.10	62.90	65.31	59.43
TiO_2	0.43	0.54	0.07	0.08	0.62	0.91
Al_2O_3	13.70	14.90	13.50	17.20	14.54	15.84
Fe_2O_3	1.38	3.43	0.39	1.12	2.22	5.24
FeO	1.89	1.47	0.44	0.70	4.27	1.97
MnO	0.02	0.09	0.01	0.02	0.15	0.07
MgO	0.54	0.54	0.10	0.40	2.34	2.71
CaO	1.75	3.37	1.09	3.50	4.56	1.73
Na_2O	3.36	8.54	4.30	9.94	3.31	8.76
K_2O	4.64	0.15	4.27	0.25	2.01	1.15
P_2O_5	0.07	0.24	0.01	0.16	0.15	0.22
LOI	0.39	2.69	0.24	2.86	1.18	1.80
Trace eiements (ppm)						
Ba	349	167	219	124	357	367
Rb	177	79	165	21	83	51
Sr	108	114	186	114	313	148
Pb	39	83	28	55	12	27
Th	5	2376	7	407	<5	9
U	<10	4877	<10	279	<10	478
Nb	6	105	5	31	7	23
Y	10	271	11	141	21	46
Zr	96	87	79	92	119	194
V	<10	18	<10	15	91	135
Cr	<6	<6	<6	<6	91	89
Ni	5	21	5	7	52	58
Co	5	<4	<4	<4	21	23
Cu	4	4	6	10	4	77
Zn	19	28	17	9	75	83
Ga	15	22	17	20	14	17
Sc	<2	7	<2	<2	15	20
S	<50	3847	<50	87	<50	271