spilitization, epidotization, keratophyrization and silicification. Basaltic andesites show actinolite (substituting clinopyroxene), chlorite, albite, epidote, quartz and opaques. Porphyritic types bear relic phenocrysts of magmatic hornblende. Keratophyrized dacites and rhyolites show quartz, albite, chlorite, epidote, zircon and opaques.

Spinifex-textured MBVU-rocks have been referred to previously as komatiites or basaltic komatiites; this is not sustained mineralogically nor geochemically. These rocks present tremolite-actinolite, chlorite, albite, talc, epidote, carbonate and opaques. Pseudomorphosed acicular clinopyroxene spinifex textures predominate by far over those of bladed olivine, typical of (peridotitic) komatiites. SiO_2 reaching the range of intermediate rocks, low TiO_2 (0.25-0.40 wt-%), and Ti/Zr$\sim$ 60 (50-75) relegate these rocks to siliceous magnesian basalts or low-Ti tholeiites linked to boninites, rather than komatiites with Ti/Zr $>$ 100 (Coish 1989). These rocks may represent extrusive equivalents of the most primitive magmas, from which AVU-andesites differentiated in infracrustal magma chambers.

Differentiated magnesian basaltic flows show a spinifex-textured andesitic top and massive ultramafic cumulate base made up of pseudomorphosed euhedric medium-grained olivines and rare relic orthopyroxenes in a tremolite-chlorite intercumulus matrix with chromite as a constant magmatic intercumulus phase.

The BVU consists mainly of basic Fe(-Mg) tholeiitic flows. All three volcanic units contain subordinate volcaniclastic and chemical intertrap metasediments. — (*December 14, 2001*) .

HEAVY METAL BEHAVIOR ASSOCIATED WITH SOIL COVER USED IN THE BANDEIRANTES SANITARY LANDFILL, SÃO PAULO DISTRICT

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Presented by Antonio C. Rocha-Campos

Soil used to cover compacted solid waste at sanitary landfills plays an important role in attenuating contamination by interfering in leachate composition and incorporating organic and inorganic substances. In order to investigate the behavior of metallic ions associated with the soil cover of the Bandeirantes Sanitary Landfill, Municipality of São Paulo, Brazil, we propose to assess the mobility and fixation mechanisms by simulating environmental conditions of sanitary ''cells'' *in vitro*.

The experiment will consist of glass columns, in which organic and metallic phases of an ''artificial waste'' will be placed upon a bed of soil and coarse sand layers, both supported on filter. Above this waste layer, a known mass of soil will be added and compacted keeping the proportions used in real sanitary landfill. Rain water or artificial rain will be allowed to percolate through the column at a rate based on known monthly precipitation. The control experiment will use soil only, taken from an intact soil profile near the landfill.

Other experiments will also reproduce the conditions equal to those in the Bandeirantes Landfill cell, but will inject rainwater and also known concentrations of heavy metals (Zn, Cr, Pb). Soil chemistry will be analyzed as well as the chemical and physical-chemical properties of the leachates such as pH, Eh, temperature, humidity and DO. These parameters will be measured, as they reflect microbiological activity during aerobic and anaerobic decomposition within the landfill; the metallic ion behavior will reveal characteristics of both biochemical and physico-chemical processes. — (*December 14, 2001*) .

THE OCCURRENCE OF INTERMEDIATE SCHORL-DRAVITE AND ALKALI-DEFICIENT, Cr-(V-)BEARING TOURMALINES IN THE VOLCANIC-SEDIMENTARY SEQUENCE OF THE SERRA DO ITABERABA GROUP – SP

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In the Morro da Pedra Preta Formation, metamorphosed volcanic-sedimentary sequence of the Serra do Itaberaba Group (northeast of São Paulo City – SP), tourmalines occur in tourmalinite, metachert, iron formation, metasediments, calc-silicate and metabasic/intermediate rocks, and hosted by quartz veins. In Tapera Grande and Quartzite areas, intermediate schorl-dravite compositions predominate. Under the microscope, these tourmalines stand out for their color, zoning (alternating light and dark greenish blue tints from core to rim), and strong pleochroism (dark blue to light brown). In general, the rims are much darker than the cores, variations due to varying Fe and Mg contents.

A second generation of light green tourmalines also occurs in quartz veins of Quartzite. These are alkali-deficient, Cr- and V-bearing tourmalines with higher Mg# than those of the schorl-dravite series. The occupancy of the X-site, according to X-ray fluorescence data, is $\delta_{0,51}Ca_{0.33}Na_{0.15}$, thus corresponding to foitite, considered as an alkali-deficient schorl.

Raman studies also discriminated two groups of tourmalines, one belonging to the buerguerite-schorl series and the other to the dravite-buerguerite-uvite series.

Stable isotope data allowed to define sediment and hydrothermal waters as fluid sources, ruling out the association of the tourmalines with *e.g.* the Brasiliano granitoid bodies found in the area. $\delta^{18}O$ compositions for tourmalines (+12 per mil) and host metachert and quartz veins (+13 per mil) are very similar, showing fluid equilibration during (re)crystallization of quartz and tourmaline.

The presence of at least two distinct groups of tourmalines indicates distinct environments and timing for tourmaline generation. In Tapera Grande, tourmalines were formed in a submarine exhalative-sedimentary environment. Their composition was not strongly affected by medium-grade metamorphism.

In Quartzite, tourmaline compositions reflect that of the country rock, once fluid percolation along Sertãozinho fault and associated fractures caused leaching of Cr (and V) and the crystallization of alkali-deficient, Cr-(V-)bearing tourmalines in veins, together with quartz. The heat source for mineralizing fluids must have been a granitoid body (Pau Pedra) south of Tapera Grande and intermediate to acid pipes in the Quartzito area. These fluids were also responsible for distinct types of mineralization, characterized in Tapera Grande by the assemblage gold-pyrite-pyrrhotite-chalcopyrite, and in Quartzite by electrum-pyrite-chalcopyrite-sphalerite-galena-scheelite-molibdenite. — (*December 14, 2001*).

A BONE FRAGMENT OF A PROBABLE AQUATIC VERTEBRATE IN THE SERRA ALTA FORMATION (UPPER PERMIAN OF PARANÁ BASIN)

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Presented by Antonio C. Rocha-Campos

We have found a robust bone fragment (4cm long; 2.5cm in average diameter) in a suspension deposit of the Serra Alta Formation, Upper Permian of the Paraná Basin, along the Castelo Branco highway near Cesário Lange (SP). The bone expands towards one end with longitudinal protuberances and has fine superficial striae. The fossil-bearing sediments comprise submetric and metric beds of dark-gray siltstone with centimetric intercalations of dirty carbonate exhibiting bioturbation, coprolites and fossil remains (hardgrounds).

This skeletal fragment is interpreted as probably part of a posterior (bones: tibia; fibula; femur) or anterior (bones: radius; ulna; humerus) limb of an aquatic reptile or amphibian or, possibly, as a portion of the fin of a crossopterygian fish.

On the basis of thin sections of transverse cuts of the bone, it was possible to observe the original phosphatic nature (with low birefringence, concentric lamellae, negative elongation, and wavy extinction) and structure of the submilimetric and milimetric pore-canals filled by microcrystalline silica, as well as subordinate calcite cement.

This bone fragment was preserved due to the relative anoxic depositional conditions of the Serra Alta Sea, the low hydrodynamic energy of sedimentation, and the presence of alkaline fluids during early diagenesis which filled bone voids, mainly its pore-canal system with $CaCO_3$.

The fragment is massive but slightly broken at both ends. Its massive nature contrasts with the much smaller and more fragile bones of mesosaurids of the subjacent Irati Subgroup (the most stagnant palaeoenvironment of Paraná Basin). Its body may have reached around 1.5m, in length, making it perhaps the largest aquatic organism of its time. If it was carnivorous, it would have been a considerable threat to the other animals of the Serra Alta Sea. — (*December 14, 2001*).

HEAVY METALS IN CONTAMINATED SOILS – SEQUENTIAL EXTRACTIONS

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In order to understand the mechanisms of contamination by metals, it is necessary to know the ways in which