SESSIONS OF THE ACADEMIA BRASILEIRA DE CIÊNCIAS

SUMMARY OF COMMUNICATIONS

REGIONAL EARTH SCIENCES IGc-USP

Organizer:

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TECTONO-SEDIMENTARY EVOLUTION OF THE ITARARÉ SUBGROUP (LATE PALEOZOIC) IN THE SOUTHERN PONTA GROSSA ARCH, BRAZIL*

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The tectono-sedimentary evolution of the Itararé Subgroup (Late Paleozoic) in the southern flank of the Ponta Grossa arch, States of Santa Catarina and Paraná, Brazil, is interpreted through stratigraphic analysis of outcropping beds. Its evolution seems to have been influenced by faulting causing rising and falling of the arch.

The section analyzed runs some 50 km SE-NW, from Mafra (SC)-Rio Negro (PR) to Lapa (PR) and includes about 700 m thickness of glacio-clastic beds assigned to the Campo do Tenente and Mafra formations.

Paleocurrent orientation, sense of the movement of the gravity driven Paraná glacial lobe, and stratigraphic data indicate a basin paleoslope initially dipping 7' N during deposition of the Campo do Tenente Formation. Isopach data shows that the unit fills a large trough trending NW, resting on abraded and striated rocks of the Paraná Group (Devonian). This interpretation implies a tectonically negative behavior of the Ponta Grossa arch during this time, also shown by isopach maps of palynobiostratigraphic intervals G and H_1 (Santos et al. 1996. Pal, Pal, Pal, 125: 165-184).

A change in the paleoslope toward SW in the upper part of the Itararé Subgroup is suggested by the orientation of gravity mass-flow deposits in the lower part of the Mafra Formation. This and the isopach data for equivalent palynobiostratigraphic intervals H_2-H_3 point to the Ponta Grossa arch becoming tectonically emergent.

A final change in the paleoslope toward N-NW in the uppermost part of the Itararé Subgroup (interval I_1?) is again suggested by orientation of paleocurrents and trend of the Lapa sandstone, a sinuous, long, linear body that seems to fill a subglacial tunnel valley. The valley cuts through Mafra and Campo do Tenente beds down to basement rocks of the Paraná Group at its northern end. This is interpreted as tectonic negative behavior of the Ponta Grossa arch. We propose that the sedimentary filling of the Lapa tunnel valley might be coeval with deposition of the Mafra and the Rio do Sul formations. — (*December 8, 2000*) .

* Apoio FAPESP, Processo No. 97/13973-2.

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THE TWO MOST IMPORTANT LATERITIZATION CYCLES IN THE AMAZON REGION AND THEIR PALEOECOLOGICAL IMPORTANCE*

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Presented by ANTONIO C. ROCHA-CAMPOS

The great part of the Amazon landscape has been developed over lateritic terrain. Geomorphological aspects, horizon toposequence, as well as the textural, mineralogical and chemical characteristics of the laterites leads to recognition of the two most important lateritization cycles in the region. The first one during the Early Tertiary created **Mature Laterites**, and the second during the Late Tertiary and Quaternary created **Immature Laterites**. Over the mature laterites developed the plateau landscape, represented for example by the regions of Carriages, Torments, Paragominas, Maicuru and Maraconaí, State of Pará; Pitinga, Seis Lagos, State of Amazonas; and Gurupi-Maracaçumé, states of Pará and Maranhão. Associated are large ore deposits (iron, bauxite, kaolin and manganese, also gold and Al-phosphates). On the other hand, the immature laterites developed on lowland plains, except in areas occupied by Quaternary sediments, even between the plateaus with mature laterites. This means that most of the present Amazon landscape developed over immature laterites. These laterites are barren of bauxite, Al-phosphates and high-grade iron ore but they do contain less important kaolin, manganese and gold deposits.

The mature laterites display well developed vertical profile with thick iron crust. The typical minerals are gibbsite, crandallite group minerals, variscite, wardite, augelite and hematite, which are not found in the immature laterites, except hematite. Mature laterites are strongly leached of SiO_2 and alkalis, but Al_2O_3 and Fe_2O_3 are enriched in comparison to the immature ones. Mature and immature laterites suffered distinct alteration processes after their formation (latosol formation, neotectonic deformation, erosion, bedrock of lake sediments and swamps, podzol formation, etc.).

These laterites and their alteration products demonstrated that the Amazon region experienced several climatic changes during the Tertiary and Quaternary. A long humid and hot to dry climate phase caused formation of the mature laterites followed by very humid phase which formed thick latosols. A second humid to briefly dry climate phase developed the immature laterites. Finally during the Quaternary a very humid climate, with a very short dry hiatus generates widespread latosols, sand podzols, lake sediments, lake and swamp iron carbonates and most recently the lakes, swamps and the dense, extensive drainage system plus the lush rain forest. — (*December 8, 2000*) .

* Supported by: CNPq, CAPES and DAAD.

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MACRO AND MICROPHYTOFOSSILS STUDY OF THE ITARARÉ SUBGROUP AT KM 96 Of BANDEIRANTES HIGHWAY, CAMPINAS MUNICIPALITY, SP*

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Outcrops recently exposed by construction at Km 96 of Bandeirantes highway, near Campinas, SP, have yielded a phytofossiliferous assemblage of abundant megaspores, bryophytic axes, unidentified caulinar axes and palynomorphs in massive dark-gray mudstones, with rhythmic intercalations of very bioturbated fine and very fine sandstone of the Itararé Subgroup. The following taxa have been identified:

Megaspores – *Sublagenicula brasiliensis*, *Sublagenicula sinuata*, *Calamospora* sp. and *Trileites tenuis*;

Palynomorphs – *Puntactisporites gretensis*, *Psomospora detecta*, *Cristatisporites rollerii*, *Cristatisporites morungavensis*, *Cristatisporites spinosus*, *Cristatisporites* sp. 1, *Cristatisporites* sp. 2, *Lundbladispora riobonitensis*, *Vallatisporites ciliaris*, *Vallatisporites vallatus*, *Vallatisporites* sp., *Raistrickia rotunda*, *Raistrickia pinguis*, *Plicatipollenites malabarensis*, *Plicatipolletines gondwanensis*, *Potonieisporites brasiliensis*, *Potonieisporites novicus*, *Potonieisporites magnus*, *Potonieisporites neglectus*, *Limitisporites rectus* and *Limitisporites hexagonales*;

Macrophytofossils – *aff. Dwykea* sp.

This phytofossiliferous association suggests the

existence of a possibly tundra-like vegetal covering, consisting of bryophytes, lycophytes, sphenophytes and gymnosperms (probable pteridospermaleans and coniferaleans). The bryophytes may have occupied coastal rocks; the lycophytes, coastal plains; the sphenophytes, river banks; and the pteridospermaleans and coniferaleans, higher continental areas.

As for the depositional environment, we can infer its proximity to the continent, based on the abundance of megaspores; on the similarity of pollen grain and spore frequencies, including preserved tetrads; and on the delicate leafy caulidium of the bryophytes.

These strata belong to the *Ahrensisporites cristatus* Interval Zone, which is considered as Westphalian in age (Souza PA.2000, unpublished Doctoral Thesis, IGc/USP), of the lower portion of the Itararé Subgroup. — (*December 8, 2000*) .

* Supported by: FAPESP 97/03639-8.

HEAVY METALS OF THE ANTA STREAM S. J. RIO PRETO – SP

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Presented by Antonio C. Rocha-Campos

Diverse anthropic activities have produced meaningful quantities of residues, in which metallic elements can be found with differential forms of retention and mobility with the environment. Therefore, it is of great importance that their fixation and mobilization be studied in different environmental settings.

This study attempt to quantify metal ion pollutants from a variety of sources and their dispersion in soils, sediments, surface waters, and groundwater. Risks upon fish will also be evaluated, as fish have several physiological systems similar to those in homeothermic animals and commonly make up part of the human food chain. Such ions will be used as biomonitors, in order to establish co-relationship among the following systems: polluted environments, fish and aquatic plants.

The study site comprehends a portion of the Anta Stream northeast of São José do Rio Preto, São Paulo, which drains into the Rio Preto within the Turvo/Grande watershed. At the study site there occur several recent urban nuclei, a sanitary landfill (Construfert) with compost facility provided with capture and treatment of leachates, and a bone flour and tallow factory (Sebo-Sol).

The behavior of such ions with the biota will be determined by monitoring their harmful effects on the environment through biomonitors, systematic collection of water, and sequential extractions of soils, sediments, etc. — (*December 8, 2000*) .

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HIGH-FREQUENCY/LOW AMPLITUDE EUSTATIC PARASEQUENCES IN NEOPROTEROZOIC ALTO PARAGUAI BASIN (MATO GROSSO, BRAZIL)*

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Stratigraphic analysis of terrigenous and carbonate deposits of the Alto Paraguai basin revealed two third-order sequences (1-10 m.y.), consisting of glacial, platform, tidal-, wave- and storm-dominated shoreline, fluvial and deltaic depositional systems. Each sequence begins as a lowstand system tract followed by transgressive and highstand periods. Carbonate parasequences of Sequence 1, analyzed in outcrops in the Cáceres region, Mato Grosso, attributable to the Araras and, in part, the Raizama formations, were deposited in a warm peritidal setting made up of: association (1) subtidal deposits of dolomicrite, intradolomicrite, oosparrudite, low-angle to planar cross-stratified sandstone and siltstones; and association (2) inter- to supratidal facies consisting of dolomicrite, intradolomicrite and wavy- to megaripple-bedded intraclastic sandstone. Other features in the association (2) are hemispheroidal, planar and brain-like stromatolites, fenestral and birdseye laminations, desiccation cracks, rip-up clasts, curled mud flakes, pseudomorphs of nodular gypsum, and stromaclast/tepee breccia. The stacking patterns of meter-scale shallowing/brining-up parasequences form

a thickening-upward signature defined by an increase in subtidal facies. This trend is attributed to the transition of transgressive to highstand system tracts related to third-order relative sea-level rise and reflects the increase of accommodation space for each successive parasequence. The parasequence sets in the Alto Paraguai basin record a post-Varanger carbonate platform subjected to high frequency (fourth/fifth-order)/low amplitude eustatic cycles in response to lower frequency (third order)/higher amplitude sea level change. — (*December 8, 2000*) .

* Supported by: FAPESP.

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HYDROCARBONS IN CARBONATE ROCKS OF THE NEOPROTEROZOIC ALTO PARAGUAI BASIN, MATO GROSSO, BRAZIL*

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A singular occurrence of hydrocarbons (bitumen) was found in Neoproterozoic carbonate rocks of the Araras Formation (Alto Paraguai basin) in the Terconi quarry (Mirassol d'Oeste, Mato Grosso, Brazil). The bitumen occurs in a transgressive carbonate succession overlying Varanger tillites, that consists of two facies associations: (1) lagoon complex, with pink parallel-laminated dolomicrites and fenestral stromatolitic biostromite, and (2) tidal-flat complex, represented by terrigenous gray micrites and pseudosparites, with parallel lamination, asymmetric ripple marks, tepee breccia, planar stromatolites and evaporites. When fresh, the bitumen is compact and vitreous, filling fractures, stylolites and dissolution cavities, generally associated with calcite cement and euhedral dolomite crystals. Microscopic examination shows the bitumen filling pores of primary (fenestral) and secondary (moldic and intragranular) origins. As the first record of hydrocarbon in Neoproterozoic rocks of the Paraguai Belt, this occurrence opens a new perspective for the evaluation of oil potential in Precambrian rocks of Central Brazil. — (*December 8, 2000*) .

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THE ARAÇATUBA PALEOSWAMP AND THE BAURU BASIN INITIAL SEDIMENTATION*

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Presented by ANTONIO C. ROCHA-CAMPOS

The Bauru Basin (lower Cretaceous) corresponds to a continental sandy succession, on a basaltic substratum (Serra Geral Formation, Early Cretaceous). Its first depositional phase, essentially desertic, corresponds to a progressive burial of the basaltic surface by a widespread and homogeneous sandy blanket, formed mainly by eolian sheets, with small dunes and minor interbedded loess deposits. The rare fluvial deposits of this phase refer to desert flash floods wadis. The original relief of the substratum favored the formation of an endorrheic drainage system in the interior of the basin, causing the appearance of a large swampy area under semi-arid climate, the *Araçatuba paleoswamp*.

The swamp deposits (Araçatuba Fm.) comprise siltstone and tabular strata of very fine, massive sandstone, up to decimeters thick, with typical greenish-gray color. Carbonatic cement may form tabular crusts parallel to the stratification. Sometimes, fining upward beds show incipient planar lamination in their upper part, where desiccation cracks and root marks are common. Dolomite pseudomorphs and moulds and pseudomorphs of gypsum radial fibrous aggregates were identified. The crystal moulds may be associated with root marks, indicating subaerial exposition cycles. Mudstones with crystal

moulds occur sporadically interbedded with climbing-ripple cross-laminated siltstones, that characterize deposition in calm shallow saline waters undergoing phases of subaerial exposition. In the Araçatuba Formation occurrence area, sigmoidal sandy bodies, sometimes with convolute bedding, suggest deposition, sliding and fluidization of marginal aqueous deposits. The constant arrival of wind-blown sand, that initially formed dunes and sand sheets marginally to the swamp, buried the original depression. The Araçatuba Formation is enclosed and overlain by eolian deposits of the Vale do Rio do Peixe Formation. — (*December 8, 2000*) .

* Supported by FAPESP.

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THE PIRAMBÓIA-BOTUCATU SUCCESSION (LATE PERMIAN – EARLY CRETACEOUS, PARANÁ BASIN, SÃO PAULO AND PARANÁ STATES): TWO CONTRASTING EOLIAN SYSTEMS*

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The Pirambóia-Botucatu succession (São Bento Group, Late Permian to Early Cretaceous of the Paraná Basin) was studied in outcrops in the States of São Paulo and Paraná. This succession comprises sandstones and sandy-siltstones of eolian depositional systems. The basal eolian sandstones interfinger with Permian coastal siltstones (Corumbataí and Teresina formations; Passa Dois Group). The top boundary is defined by an extensive supersurface (hundreds of kilometers) developed by lava flows of the Serra Geral Formation (Early Cretaceous). The sandstone succession is characterized by extra-erg and erg core deposits, corresponding to dune fields, wet and dry interdunes, oueds and alluvial plain deposits. The identified dune types are predominantly barchans and barchanoid chains. The upward succession may be subdivided into five main facies associations: (1) tidal plain with eolian sand sheets; (2) coastal dunes with frequently flooded interdune flats; (3) coastal dunes with rarely flooded interdune flats; (4) braided alluvial plain with eolian dunes; and (5) giant dunes with interdune depressions. Associations 1 to 4 correspond, in a broad sense, to the Pirambóia Formation and record a wet eolian system – an eolian depositional system whose phreatic level was close to the depositional surface (*Pirambóia wet eolian system*). In association 5, sand dune facies prevail in a draa-erg context and the low-angle cross-bedded sandstones occur rarely, suggesting the existence of dry interdunes. This association belongs to Botucatu Formation (*Botucatu dry eolian system*).

The higher phreatic level of the Pirambóia eolian system can be assigned to proximity of the coast, in an arid climate. The evidences for this interpretation include transitional contact between eolian and coastal systems, presence of high-strontium (up to 650 ℓg/g) fibrous ooids in the Teresina subtidal deposits, and existence of palygorskite as cement in the eolian sandstones.

The Botucatu eolian system rests abruptly on the fluvio-eolian deposits of Pirambóia system, along a planar regional surface, probably erosional in character. The difference of age (more than 100 Ma) and the contrast between the Pirambóia (wet) and the Botucatu (dry) eolian systems are important criteria to define this regional surface as a remarkable unconformity. — (*December 8, 2000*) .

* Supported by: FAPESP.

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AQUIFER SYSTEMS CHARACTERIZATION IN CAMPOS DOS GOYTACAZES MUNICIPALITY, RIO DE JANEIRO, BRAZIL*

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Presented by Antonio C. Rocha-Campos

We present a hydrogeological study aimed at defin-

ing some aquifer systems and their potential to supply Campos dos Goytacazes Municipality, Rio de Janeiro State, Brazil. Campos dos Goytacazes is the largest municipality of Rio de Janeiro State (4,017.7 Km^2) and it is located at 21°45'15''S and 41°19'28''W. The city is 48 km from the Atlantic Ocean, and it is situated on the Campos Sedimentary Basin, close to the delta of the Paraíba do Sul river. The project comprised regional geological studies, 3D aquifer geometry evaluation, and the analysis of the sedimentary environment. These integrated studies and the hydrogeological evaluation 4 aquifer systems are as follows:

(1) Crystalline basement rocks – low potentiality and secondary porosity, with specific capacity values varying from 0.021 to 1.53 m^3/h/m;

(2) Emborê Formation – composed by sandstone and shale, is a confined aquifer system with productivity values around 3.5 m^3/h/m, and transmissivity of 232.16 m^2/day;

(3) Barreiras Formation – composed of sand, clays and silts, is an unconfined to confined (artesian sometimes) aquifer, with productivity values from 0.27 to 10.48 m^3/h/m and transmissivities between 6.27 and 2048.20 m^2/day, and

(4) Quaternary Delta Aquifer System – composed of continental and marine sediments (residual soils, sand, gravel, clays and silts), with high productivity values (from 0.04 to 132.31 m^3/h/m) and high transmissivities (from 245.76 to 9023.62 m^2/day). These aquifer systems are a cheap and simple source to supply both urban and rural areas of Campos dos Goytacazes. The aquifer systems are presented on the Hydrogeological Map (scale 1: 200,000). — (*December 8, 2000*) .

* Supported by FAPESP.

FROM SAND RICH TO MIXED SAND-MUD RAMP DEEP-WATER SYSTEM: A CONCEPTUAL MODEL FOR THE APIUNA SUCCESSION (CAMBRIAN, ITAJAÍ VALLEY, BRAZIL)*

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The Apiúna succession is one of the best-exposed deep-water deposits in Brazil. Deep-water deposits represent 88.6% of the oil reserves in Brazil and their study is, therefore, of great importance for the oil industry. This work proposes a new depositional and geometric interpretation of the Apiuna succession, based on a very detailed facies analysis (scale perception < 3 cm of thickness) and on currently circulating scientific ideas on deep-water sediments.

Alongside road BR-470 (in the central-eastern Sate of Santa Catarina), 209 m thick of deep-water deposits were examined. Four informal stratigraphic units, from A at bottom to D to the top, are recognized. **Unit A** records a slightly inclined slope made up of sand-starved silty argillites and twisted muddy strata. **Unit B** consists of sandstone strata, 4-100 cm thick, alternating with silty argillites, abruptly overlying unit A. **Unit C** comprises amalgamated sandstones, 25-180 cm thick. The sandstone strata in unit B and C have a sheet shape. In unit C the sandstones are massive and coarser, while those in unit B have frequent cross-laminated at the top. Sandstone sheets were mainly deposited by sandy debris flows; depositional flows were bipartite: debris flows deposits were reworked at the top by turbidity currents. Absence of vertical organization of the B and C unit sandstone suggests a multisource sandy input. Units C and B represent a distal and proximal part of a sandy-rich ramp setting respectively. **Unit D** is a coarsening and thinning upward sequence, going from erosively based conglomeratic sandstones to lenticular sandstones alternated with silty-argillites. It represents an erosive depression fill passing upward to levee sediments within a mixed sand-mud ramp.

In conclusion the depositional environment of the Apiúna succession changes from sand-starved muddy slope (unit A), to irregular sandy-sheet built ramp (unit B and C) and channel-levee of sand-mud ramp (unit D) caused complicated depositional architectures. Tectonically induced morphological variations may have controlled the environmental modifications. — (*December 8, 2000*) .

* Supported by FAPESP and CETPETRO.

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GEOLOGY AND PETROGRAPHY OF THE GRACIOSA GRANITES (SOUTHERN BRAZIL)

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The Serra da Graciosa region in eastern Paraná State (southern Brazil) concentrates important A-type granitic and syenitic massifs – the Graciosa Granites – that are part of the Serra do Mar Province. They are intrusive in Archean granulites of the Luiz Alves Craton and in Neoproterozoic gneisses of the Curitiba Microplate and formed during the post-orogenic stages of the Brasiliano Cycle.

In this study, we characterize the geology and petrography of the Graciosa Granites using information from field work, petrography and the interpretation of TM-Landsat images and aerogammaspectrometric maps. It was thus possible to differentiate rheologically independent areas formed by one or more intrusive units that are circumscribed by basement rocks. These are here defined as separate massifs.

Five massifs are identified among the Graciosa Granites. Both the Marumbi and the Anhangava Massifs have been identified previously. Until now the remaining three have been considered as a single massif – the Graciosa Massif. The presence of basement rocks inside the Graciosa Massif is portrayed in the works of Maack in the 1960's, and the structural independence of the three massifs is evident in satellite images and maps, as well as in the field. Therefore, we propose that the designation Graciosa Massif be discarded in favor of the following specific designations, from north to south: Capivari, Órgãos and Farinha Seca Massifs. The five massifs appear as ellipses oriented NE-SW and each occupies an area ranging from 34 to 100 km2.

A large variety of granitic and syenitic rock types is found. Amphibole alkali-feldspar granites make up both the Farinha Seca Massif and the easternmost part of the Órgãos Massif. The gradual variation from calcic to sodic amphibole reveals an affinity with an *alkaline* A-type association. In the northern and southernmost parts of the Anhangava Massif, ± olivine ± clinopyroxene ± amphibole ± quartz alkali-feldspar syenites and minor amphibole alkali-feldspar granites characterize a second *alkaline* association. Biotite syenogranites, monzogranites and alkali-feldspar granites, usually bearing calcic amphibole, are attributed to an *aluminous* A-type association. They are present in the central area of the Anhangava Massif, in the Capivari Massif, in most of the Órgãos Massif and in the Marumbi Massif. — (*December 8, 2000*) .

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ORIGIN AND PRESERVATION OF STRATIGRAPHICALLY REPEATED, GLACIALLY STRIATED SURFACES IN THE ITARARÉ SUBGROUP (LATE PALEOZOIC) IN PALMEIRA, STATE OF PARANÁ*

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Rocha-Campos et. al. (1999, Anais ABC, 71: 841) interpreted the multiple striated surfaces from the Itararé Subgroup in Palmeira as having been abraded subglacially on soft sediment by a terrestrial glacier with an oscillating margin. Four to five surfaces are exposed, cut on top of a fluvio-glacial, fine-medium, cross-bedded sandstone.

Important characteristics of the surfaces are: absence of deformation of the sandstone; thin sand beds (dm) separating surfaces; occurrence of striated areas side by side with non-striated and ripple-marked areas; the probable fluvio-glacial nature of the sandstone; absence of diamictite in the section; absence of lodged clasts; and presence of centimetric beds/laminae of siltstone on top of most of the surfaces and a decimetric bed of siltstone on top of the uppermost surface.

These features indicate a possible combination of low effective pressure of the glacier, a rigid substrate, sandy glacier bed with low pore water pressure and possible presence of a subglacial water layer. Glacial abrasion occurred by ploughing by ice protuberances under the glacier that was not completely in contact with its bed, probably partially floating on a thin water layer.

Still controversial is why the surfaces have been preserved. Evidence of subglacial carbonate cementation of the surfaces was not found and preservation of the subglacial features by cold-based deglaciation can be ruled out by the absence of associated permafrost features.

On the other hand presence of the silt layers above the surfaces suggests that they may have been protected from further erosion by deposition of a cover of fine sediment on top of them. This raises the question on whether the sliding glacier was subaquatically grounded, or if terrestrially based, the abraded surfaces were immediately covered by water of ephemeral glacial lakes or pools after retreat of the ice. The second explanation seems more plausible to us in view of the fluvio-glacial nature of the striated sandstone. Another vexing question refers to the absence of subglacial till deposits in the section. We propose that movement of the Paraná lobe on the underlying Furnas sandstone led to entrainment of large amounts of sand in the basal debris layer of the glacier, later released and reworked by fluvio-glacial action. — (*December 8, 2000*) .

* Supported by: FAPESP.

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MULTIDISCIPLINARY THEMES

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A FAST ALGORITHM FOR COMPUTING THE HARTLEY/ FOURIER SPECTRUM

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Discrete transforms have been playing a relevant role in several areas, especially in Engineering. An interesting example is the Discrete Fourier Transform (DFT). Another very rich transform related to the DFT is the Discrete Hartley Transform (DHT), the discrete version of the symmetrical, Fourier-like, integral transform introduced by Ralph V.L. Hartley. Besides its numerical side appropriateness, the DHT has proven over the years to be a powerful tool. A decisive factor for applications of the DFT has been the existence of the so-called fast transforms (FT) for computing it. Fast Hartley transforms also exist and are deeply connected to the DHT applications. Recent promising applications of discrete transforms concern the use of finite field Hartley transforms to design digital multiplex systems, efficient multiple access systems and multilevel spread spectrum sequences. Besides being a real transform, the DHT is also *involutionary*, i.e.; the kernel of the inverse transform is exactly the same as the one of the direct transform (self-inverse transform). Since the DHT is a more symmetrical version of a discrete transform, this symmetry is exploited so as to derive a new FT that requires the minimal number of real floating point multiplications. A FT algorithm for the DHT is also a FT for the DFT and vice versa.

Discrete transforms presenting a low multiplicative complexity have been an object of interest for a long time. The minimal multiplicative complexity, μ, of the one-dimensional DFT for all possible sequence lengths, N, can be computed by converting the DFT into a set of multi-dimensional cyclic convolutions. In this work a fast algorithm is derived, which meet the lower bound on the multiplicative complexity of a DFT/DHT for short blocklengths. It is based on a multilayer decomposition of the DHT using Hadamard-Walsh transforms. These new schemes are attractive and easy to implement using a Digital Signal Processor (DSP) and the regularity of the structure allows the design of low-cost high-speed dedicated Integrated Circuits. — (*May 18, 2001*) .

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MAGNETIC NANOSTRUCTURES

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Advances in surface science and nanofabrication techniques made research in small magnetic structures a very attractive field in recent years. In particular, the injection of spin-polarized carriers in metallic magnetic nanos-

tructures is of considerable interest due to its importance to information technology. Prospective devices based on spin-dependent transport include magnetic sensors for high-density data storage media, and radiation-hard non-volatile magnetic random access memories (MRAMs). Hence, there are hopes for radiation-resistant satellites and bootless computers in the foreseeing future. All that stems from the prodigious developments of planar electronics that now make ultrathin magnetic films the starting point of current research activities. This work reviews results of a detailed investigation of the prototype Fe/Cr/Fe system carried out in our laboratories. It is shown that consistent values for all magnetic parameters can be extracted from the data of four different experimental techniques with a theory that treats both static and dynamic responses on equal footing. In addition, magnetic excitations (spin waves) are shown to be strongly driven by a microwave current through this system, and interesting nonlinear phenomena are predicted to occur in the high-bias regime of an applied *dc* current. The resulting device has been called SWASER, given its analogy to the existing injection LASER. — (*May 18, 2001*) .

NEW MATERIALS FOR PHOTONIC DEVICES – HYBRID SYSTEMS AND NANOSCIENCE

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Presented by GILBERTO F. DE SÁ

We have developed a wide class of new materials for photonic device applications using lanthanide ions in complex, thin films complex, oxides, fluorides and metallic thin films and nanoparticles, conjugated with glasses, glassceramics, ceramics, hydrogels and enamels, characterizing hybrid systems for photonic and optoelectronic devices.

Some precursors of those materials, like oxyfluoride glasses with silver nanoparticles, were developed by our group more than 15 years ago (Malta OL et al. 1985. Chem Phys Lett 116:396), in the time that nanoscience was not *fashionable*. Nowadays we are developing devices for applications in pollution, toxins using immunoassay, up-conversion tracking of medical drugs in body and radiation dosimeters. A personal low-cost ultraviolet dosimeter of high sensitivity and selectivity to UV-A, B and C was developed using photonic process, resulting in a molecular device to skin cancer prevention (Santa-Cruz PA and Gameiro CG 1999. Patent # PI9705743-6 Brazil, RPI 1490:187). Two kinds of materials were used as the active part of the device: a thermoevaporated thin film of Eu^{3+} complex or the complex powder dispersed in an enamel-like medium by spin-coating. In both systems that use glass substrates, the Eu^{3+} red emission ($^5D_0 \rightarrow {}^7F_2$ transition) decreases as a function of UV dose. This reduction is irreversible, giving it a *memory effect* which allows dosimetry measurements. All measurements may be related to the MED (minimum erythemal dose) of 28 mJ/cm^2, because a calibration curve, from an integration sphere/radiometer, provides absolute dose measurements. A ligand-dependent process justifies the selectivity presented by the dosimeter, and explains the mechanism of the complex photodegradation at molecular level. We conclude that hybrid systems have large potential for use as active parts of photonic and integrated optoelectronic devices for sensors and dosimetry applications. — (*May 18, 2001*) .

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AUTOTRANSPLANT OF SPLEEN TISSUE IN CHILDREN WITH SCHISTOSOMIASIS: EVALUATION OF SPLENIC FUNCTION AFTER SPLENOSIS

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Presented by HELIO B. COUTINHO

Autotransplantation of spleen tissue has been done, in the past ten years, in children with *Schistosomiasis mansoni* with bleeding varices. The purposes of this investigation were: to study the morphology and function of the remnant spleen tissue, to quantify the production of tuftsin; and to assess the immune response to pneomococcal vaccine of these patients. Twenty three children, who underwent splenectomy and autologous implantation of spleen tissue into the greater omentum were included in

this investigation. The average postoperative follow-up is five years. Splenosis was proved by colloid liver-spleen scans. Search for Howell-Jolly bodies assessed the filtration function. Tuftsin and the titer of pneumococcal antibodies were quantified by ELISA. Splenosis was evident in all children; however, it was insufficient in two. Howell-Jolly bodies were found only in these two patients. The mean tuftsin serum concentration (335.0 $\pm$ 29.8 ng/ml) was inside the normal range. The immune response to pneumococcal vaccination was adequate in 15 patients; intermediate in four; and inadequate in four. From the results the following conclusions can be drawn: Splenosis was efficient in maintaining the filtration splenic function in more than 90% and produced Tuftsin inside the range of normality. It also provided the immunologic splenic response to pneumococcal vaccination in 65% of the patients of this series. — (*May 18, 2001*) .

CONTROL OF FILARIASIS INSECT VECTOR IN RECIFE, PERNAMBUCO, NORTHEASTERN BRAZIL

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Presented by Helio B. Coutinho

Lymphatic filariasis is a major public health problem in the city of Recife. In some urban areas, microfilaraemia prevalence reaches 14%. In this study, a parasitological survey was performed covering 5563 subjects in the districts of Coque and Mustardinha. In both areas, the prevalence of microfilaraemia was 10%. Microfilaraemia was detected by the thick smear technique. 45μl of blood was collected between 20:00 and 24:00h.It is assumed that *C. quinquefasciatus* is the sole vector of bancroftian filariasis in Recife and that transmission occurs almost entirely in domestic and peridomestic settings.

In addition to breeding ecology, evaluation of imago density were assessed by standard methods such as count of resting mosquitoes and by using CDC miniature light traps settled both inside and outside the houses. The following morning mosquitoes were counted and dissected to determine filarial infection and infectivity indices.

Mass treatment with Dietylcarbamazine (DEC) using low and spaced doses was employed in both areas. In one such instance DEC therapy was associated with vector control using physical measures and periodic treatment of *Culex* breading sites with the entomopathogen *Bacillus sphaericus* as larvicide. The vector population density, reaching 60-200 Culex/room/night, before the intervention was drastically reduced to 4-10 Culex/room/night, and maintained at this level for more than two years. Mass treatment with DEC resulted in a drastic reduction of *C. quinquefasciatus* infection rates in Coque from 3.11%, recorded before the treatment to 0% after the adopted control measures. Microfilaraemia rates were reduced in 99.8% in Coque and 98.7% in Mustardinha. The maintenance of endemic filariasis in Recife is certainly associated with the low quality of life in most of the urban areas. Control strategies must be adapted to existing urban conditions and directed to endemic communities, otherwise the endemic will probably expand in the city in the next few years. — (*May 18, 2001*) .

GEOGRAPHICAL INFORMATION SYSTEM APPLIED TO PUBLIC HEALTH

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Presented by Helio B. Coutinho

Where Public Health Services decided to incorporate the ''TERRITORIAL APPROACH'' as an essential element in the analysis and intervention on population health problems, new perspectives to the study of the extreme social disparity that exists in many countries worldwide were opened. The study of standard of living and health of human groups, according to their place of residence, becomes a methodological alternative to identify and analyze their necessities, and in consequence make possible to overcome these iniquities. Recent advances in computational techniques of data analysis and mapping, became themselves important tools to support the development of these studies and allowed the improvement of new proposals. A field of application for those new techniques is undoubtfully the study of distribution and epidemiologic characterization of the occurrence of endemics in urban

areas, aiming the formulation of new control strategies. Among these endemics, Lymphatic filariasis occurs in a wide geographic distribution in greater Recife, Brazil, and the intensity of transmission is a real and potential threat to public health in affected communities. Intervention strategies that have been adopted in Recife, for the last 50 years, were characterized by actions without considering the social context in which persons are living and so with limitted efficacy. Taking into account these evidences, this study intends to elaborate a new strategy of intervention in which the identification of Risk Spaces will be considered. This intervention model will allow us to identify the prioritary (priority?) populational groups according to the risk of being infected, taking into consideration the intrinsic relationship between the behavior of the endemy and the space where the disease occurs. — (*May 18, 2001*) .

CARBON AND STRONTIUM ISOTOPE RECORD ON THE VENDIAN-TOMMOTIAN TRANSITION IN THE NW ARGENTINA

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Carbonates of the Las Tienditas Fm., Salta province, recorded the Vendian-Tommotian transition in the top of this carbonate sequence, while carbonates of La Laja Fm., San Juan, recorded this transition next to the base of the Formation. $\delta^{13}C$, $^{87}Sr/^{86}Sr$, Si, Mg/Ca, Mn, Fe and Si chemostratigraphic profiles in the uppermost portion of Las Tienditas are very similar to those for the lowermost portions of La Laja Formation, suggesting synchronous deposition. $\delta^{13}C$ values ($\sim 0‰_{PDB}$) in carbonate lenses of the Caucete Group, Pie-de-Palo complex, coupled with high $^{87}Sr/^{86}Sr$ (0.709 to 0.710) and presence of Vendian ichnofauna suggest that sediments of this Group were, perhaps, deposited synchronically with carbonates of the La Laja Fm. The high $^{87}Sr/^{86}Sr$ for all of the Formations studied resulted from the nature of the continental crust (high Rb/Sr, or very ancient crust, or both) being eroded during the time of deposition of these marine carbonates. The moderate shift of $\delta^{13}C$ from $+1‰_{PDB}$ to $-2‰_{PDB}$ in this Vendian-Tommotian transition contrasts with strong shifts observed in most localities in the world. Similar behavior has been observed in Siberia and a shift from $+5‰_{PDB}$ to $+2.7‰_{PDB}$ was recorded in Bhander and Sirbu limestones, Vindhyan basin in India. These observations demonstrate a nonuniform isotopic behavior of the Vendian-Tommotian transition, at least, for continents that once were part of Gondwanaland. — (*May 18, 2001*) .

SOIL TEMPERATURE PROFILES FOR LOCATING WELLS IN THE SEMI-ARID REGION – TECHNICAL VIABILITY, PROCEDURES AND EQUIPMENT

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Presented by ALCIDES N. SIAL

The ever-growing water demands in the Brazilian semi-arid region leads to a greater interest in its crystalline rocks as a source for groundwater. Two drawbacks are, nevertheless, known which reduce the ability of these rocks as groundwater reservoir, namely, low yields and high salt contents. With regard to the later ones, the installations of reverse osmosis desalting units are proving to be economically feasible, thus, contributing to minimize the quality problem. The minimization of the problem of low yields, on the other hand, requires an amount of field research work aiming to the detection and mapping of favorable fractured zones. Several methods may be utilized, be it geophysical approaches or not, for accomplishing this task, none of them being able to tell the presence of water in the fractured zone. A research work on shallow soil temperature, by means of horizontal profiles, was conceived and started aiming not only to the mapping of fractured zones but also to the possibility of a qualitative evaluation of the fractured reservoir. The

temperature probes, the measuring equipment and the field procedures were developed up to the present stage of the research. Preliminary field essays were conducted which point to the feasibility of the approach and encourage the pursuit of the research. — (*May 18, 2001*) .

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NEOPROTEROZOIC ACID MAGMATISM IN WESTERN INDIA

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Presented by ALCIDES N. SIAL

'Neoproterozoic' signifies an eventful period in the global tectonics as it coincides with amalgamation of different continental fragments to form a supercontinent 'Rodinia' and its subsequent break-up. It is essential to evaluate the interrelationship of different events in individual continental blocks of the Gondwana and to synthesize the pieces of evidence to reconstruct the Gondwna assembly. Although the geological evidence provide a basis for relative timing of events, the absolute ages are fundamental in attempting any meaningful correlation of the events that are now represented in widely spaced continents. The 770-750 Ma Malani Igneous Suite (MIS) in western India represents the Indian examples with analogues identified in Seychelles and Madagascar as coeval magmatic events. Some salient characteristics of the MIS are presented here.

Spread over an area of $> 51,000$ km^2 in the state of Rajasthan (NW India), the MIS is considered to be the third largest felsic volcanic province of the world. However, the magmatism is polyphase in nature with predominant felsic volcanics (at places with minor basic flows at the base) with granites and a wide array of dyke rocks (rhyolite, trachyte, dolerite/gabbroic) that intrude the earlier lithologies. Geochemically the felsic rocks (volcanics and granites) are peraluminous and peralkaline, both the varieties defining a systematic spatial relationship with each other, however, the former is the predominant facies. Geochemical features are typical of A-type granites, such as high abundances of silica, alkalis, LREE, HFSE, LILE and a high Fe/Mg ratio, with extreme enrichment of such elements in the peralkaline rocks. The geochemical features, in concert with non-orogenic emplacement, indicate derivation from high temperature melting of a lower-crustal source under thinning crust, induced by an underplating basic magma. The 'peralkalinity' was introduced by some mantle flux. Available geochronologic information (mainly Rb-Sr whole rock) is contentious as one group infers a protracted magmatic history (680-780 Ma) whereas another proposes a very short event at 730 Ma. Our U-Pb zircon data indicating 770-750 Ma for peraluminous rhyolites and granites supports a rather limited time span and coevality between volcanic and plutonic episodes. The geochronologic and geophysical evidence suggest a spatial contiguity of MIS with Seychelles and Madagascar, possibly representing the western margin of Rodinia. — (*May 18, 2001*) .

MECHANISM OF CEMENTATION IN BEACHROCKS BASED ON PETROGRAPHIC AND GEOCHEMICAL EVIDENCE

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Presented by ALCIDES N. SIAL

Sedimentologic study and geochemical analyses were carried out on carbonate beachrocks samples from the littoral of the state of Pernambuco. Framework detrital composition is siliciclastic and cemented by calcite and/or aragonite. Three stages of cementation have been identified. The first corresponds to micritic envelope; the second to a circular fringe; and the third to a cryptocrystalline cement filling pores. δ^{13}C values vary between $+3.6‰_{(PDB)}$ and $-2.0‰_{(PDB)}$ and δ^{18}O values between $+1.3‰_{(PDB)}$ and $-2.1‰_{(PDB)}$. δ^{13}C values and diagenesis features suggest what type of cementation occurred in meteoric-vadose and/or marine-phreatic by loss of CO_2 (evaporation) the interstitial water. The interaction of the carbonated fluid in subsuperficie led to a discontinuous beachrock formation. The elevation of the mean sea level caused the deposition of new sediments, that once cemented, completed the preexisting base of the beachrocks, or created a new one, explaining the variable lengths of these rocks on the littoral. — (*May 18, 2001*) .

CHRONOSTRATIGRAPHIC DATING OF CARBONATES BASED ON $^{87}Sr/^{86}Sr$ RATIO: CASE STUDIES FROM BRAZILIAN SEDIMENTARY BASINS

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Presented by ALCIDES N. SIAL

Strontium isotope stratigraphy is emerging as a powerful new chronostratigraphic tool that can be applied routinely to the correlation and dating marine sequences. The past variations of the seawater $^{87}Sr/^{86}Sr$ with time are related to changes in the relative contribution of mantle Sr input to the ocean and the Sr supply from continental weathering. The average $^{87}Sr/^{86}Sr$ ratio is 0.718 for Sr derived from weathering of continental crust and 0.703 for that derived from oceanic (mafic) crustal input. Therefore, the Sr isotope ratio in sea water is a balance between these two sources of Sr and is believed to be uniform at any given time, because the residence time of this element is much longer than oceanic mixing time.

Based on these variations of strontium isotope ratio with time, a composite strontium isotopic curve was constructed for marine carbonates of the whole Fanerozoic. The most promising high-resolution intervals of geological time correspond to those portions of the seawater curve that exhibit the greatest $^{87}Sr/^{86}Sr$ change rates as a function of time.

Two Brazilian case histories are presented, one from shallow water Eocene to Miocene marine carbonates of Cassiporé Basin, and the other from Pennsylvanian to Permian shallow water to restricted marine carbonates and anhydrites of the Amazon and Acre Basins. — (*May 18, 2001*) .

GEOCHRONOLOGY OF ORE DEPOSITS: NEW TRENDS ABOUT AGE AND LIFETIME OF THE HYDROTHERMAL SYSTEMS

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Presented by ALCIDES N. SIAL

Over the last decade we have been able to produce accurate and highly precise ages of ore-forming episodes due to the recent geochronologic techniques that allow for direct dating of ore and gangue minerals using Re-Os, Ar-Ar and stepwise leached Pb-Pb and Rb-Sr methods. The use of integrated geochronologic approaches have led us to characterize the age and thermochronological history of dynamic geologic events associated with hydrothermal and mineralizing episodes, as well as the duration and episodic nature of ore-forming events. Many authors have demonstrated that while the geological episodes take many millions of years, the hydrothermal circulation and mineralizing processes take about 10,000 to 200,000 years. Dating hydrothermal fluid circulation, mineralizations and relationships between ore-forming processes and termochronological history of igneous and metamorphic episodes will be focused. Dating ore deposits is a very complicated process, because many factors (e.g. post-mineralization geological events) may reset the isotopic systems, and measured age not necessarily indicate the true age and, many times, yield ages of no geological significance. Nevertheless, the use of multi-isotopic systems in different types of minerals may minimize this problem. Determination of precise ages by different isotopic systems, coupled with computer modeling of how long an igneous episode can sustain geothermal activity, can improve establishing the length of ore-forming episodes. — (*May 18, 2001*) .

THE AEOLIAN CALCARENITES OF THE FERNANDO DE NORONHA ISLAND, NORTHEASTERN BRAZIL – A NEW APPROACH

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Presented by ALCIDES N. SIAL

A new approach of the quaternary ''aeolian sandstones'' from Fernando de Noronha Island (FN) is presented on the basis of field observations, mineralogical and geochemical investigations, and whole rock radiocar-

bon data.

Two different calcarenite facies were distinguished in the meridional FN's coast, representing at least two different stages of aeolian dune formation followed by diagenesis. The oldest one includes calcarenites preserved in the summit places of the FN cliff border mainly, at 15 to 50m over the present mean sea level (PMSL). Typical large-scale cross-bedded units with internal high angle stratification characterize the sedimentary rocks that include low contents of silicates plus heavy minerals ($< 3\%$). The radiocarbon dating range between 42,000 to 28,000 years BP as minimum ages.

The new one is represented by the ''Tamandaré'' calcarenites, whose outcrops lie 10 to 15m over the PMSL, and include small-scale cross-bedded units with internal low angle stratification. No negligible quantities of mafic silicates plus heavy minerals (5-15%) characterize its composition. The radiocarbon dating range between 10,500 to 9,500 years BP as minimum ages.

The sub-actual dunes areas, including that which overlies the Tamandaré calcarenites, represent a last stage. The sedimentary characteristics and geographical setting suggest 10,000 to 6,000 years BP for these deposits, in agreement to a worldwide period of dune landward migration.

The general results confirm that large aeolian dune field usually were developed in the last glacial stage of the Quaternary, when extensive sand beaches surfaces were exposed to the wind by a gradual and strong sea level dropping. The calcarenite records and the sub-actual dunes both exclusively observed at the meridional FN's coast are in agreement to the predominant quaternary wind directions. The studied outcrops are the diagenetic relicts of a large and continuous aeolian dune field formed over the actual meridional FN's platform at the Würm glacial stage. — (*May 18, 2001*) .

Sm-Nd ISOTOPIC DATA FOR METABASIC ROCKS IN CENTRAL BRAZIL: CONSTRAINTS FOR THE TIMING OF MAFIC MAGMATISM AND REGIONAL MAGMATISM

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Mafic rock associations of varied nature and ages represent an important component of the Brasília Belt in central Brazil. The emplacement and metamorphic ages of mafic associations allied with their initial Nd isotopic compositions are essential to understand the tectonic evolution of the belt. Despite the poor precision normally achieved by the Sm-Nd isochron data, the ages allied with initial ratio values provide important information on the geological history of Precambrian terrains.

The oldest mafic-ultramafic rocks in central Brazil are komatiitic rocks of the Crixás greenstone belt: ca. 3.0 Ga and ε_{Nd}(T) of ca. $+1.5$, possibly representing Archean oceanic floor preserved within the oldest continental fragment preserved in central Brazil. In the sialic basement of the supracrustal rocks of the belt, the mafic sequence of Silvânia yielded an isochron age of ca. 2.1 with ε_{Nd}(T) of ca. $+2.3$. This is representative of the juvenile Paleoproterozoic of the basement of the Neoproterozoic orogenic belt. Approximately 1.9 Ga mafic intrusions represent a Paleoproterozoic continental rift (ε_{Nd}(T) of ca. -2.5): the lower unit of the Niquelândia mafic ultramafic body. The western part of the Barro Alto and Niquelândia intrusions are formed by 1.3 Ga rocks with oceanic affinity, indicating oceanic crust formation towards the end of the Mesoproterozoic. Garnet ages of ca. 0.74-0.76 Ga reveal an ''early Brasiliano'' metamorphic event. Oceanic 1.0-0.9 Ga rocks form the basal parts of island arc sequences in Mara Rosa. These are the oldest representatives of the Neoproterozoic intraoceanic arcs in the western part of the Brasília Belt. Late- to post-orogenic gabbro-dioritic intrusions dated at ca. 0.6 Ga (e.g. the Americano do Brasil and Lajeado intrusions) represent the last precambrian mafic event in the orogenic belt, associated with uplift following continental collision. — (*May 18, 2001*) .