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LOOKING FOR DIAMOND-BEARING KIMBERLITES TO MAKE WORLD CLASS DIAMOND MINES FROM SOUTH AMERICA: THE RIO APÁ CRATONIC BLOCK

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The crystalline sequence of Rio Apá Cratonic Block (**RACB**) is a small exposed Archeozoic-structure (>2.53 Ga; Cordani et al., 2005), in the central part of South America (north of Eastern-Paraguay and south of western-center-Brazil). In Brazil, they are covered by extensive Phanerozoic sedimentary sequences that according to Cordani et al. (2005) it forms the basement of the Neoproterozoic carbonate deposits of the Corumbá Group at the Bodoquena Range, and extend to the south in Paraguayan territory, where it is covered by the Itapucumí Group. Probable major extension of the **RACB** to the east and the south is masked by the Paraná Basin sediments (Paleozoic-Mesozoic) and Recent sediments (Quaternary/Actual). However, the **RACB** expansion below the Paraná Basin sediments is suggested by geophysical information:

- -P & S-wave (cf. Schimmel et al., 2003; Rocha, 2003; Heintz et al., 2005) (Fig.-1),
- -Marine-gravimetric data (on-line construction in http://www.serg.unicam.it/Gravity.htm) (Fig.-2),
- -Regional superficial heat flow (N~230-available data in: www.heatflow.und.edu, and http://www.on.br/institucional/geofisica/areapage/geotermia/badge/bdfluxo/estados.html) (Fig.-2).

Thus, the **RACB** would seem to have approximate 247.000 Km^2 (780 X 600 Km in most long side inferred diameter). This is, the **RACB** boundary extending between Paraguay, Brazil and Argentina, as is observed in the Fig.-1; where around ~150.000 Km^2 of they are located in Paraguay, ~90.000.000 Km^2 in Brazil and <10.000 Km^2 in Argentina.

So and in agreement this vision, the **RACB** is bounded: in the north by **Alto Tererê** (<2.5 Ga.), **Tucavaca** (<2.0-1.5 Ga) and **Paraguai** (<1.0 Ga) **belts**; in the eastern-southeastern by the **Ribiera belt** (<2.5-2.0 Ga); in the south by the **calc-alkaline magmatic Caapucú belt** (<1.0 Ga); in the west, by the **Cratonic-block Pampia** (<2.5 Ga); finally, the west-northwest portion of **RACB** is occupied by intra-plate volcanic rocks of the **Supersuíte Amogüijá** (<2.5 Ga). Fig.-1; cf. Cordani and Sato (1999), Cordani et al. (2005).

Likewise, according to P and S-wave data, the **RACB** show, like the Kaapvaal cratón (cf. Fouch et al., 2004), high velocity perturbations (blue-zone), that extend below 300 km (Fig.-1); this is, **RACB** lie in to high velocity region indicating a relatively thicker and cooler lithosphere.

As initially comment by Báez Presser (2005 a and b) inside of the center-north of Paraguayan **RACB**-portion (=northeaster of Concepción City in the Fig.-1) they come being recognized **KIM** (kimberlitic indicator minerals) and **DIF** (diamond inclusion field minerals) that were collected in inferred volcaniclastics (kimberlite) diamond-bearing sediments and in diamond-bearing loam-sample, both associated with very well defined circular to oblique (hundreds meters) satellite-anomalies (that were interpreted as kimberlite pipe-like), as well as, in the diamond-bearing alluvial-samples.

KIM/diamonds was also separated from a partially exposed, red-blood completely weathered porphyritic in-equigranular mica-rich brecciate rock, looked as kimberlite/orangeite breccia (Fig.-3). The exposed kimberlitic-material was fainted in well define a hundreds meters near circular anomalies; that were interpreted as pipe-like structure (KEH-02).

Data set of around 1000 grains of **RACB** mineral chemistry is now available that showing the existence of (DIF) High Cr picro-chromites and high Cr chromites, (DIF) high Si pyrope-almandine, (DIF) Juina-like ultra deep Mn-ilmenites (=TiO_2>50% and FeO_c>40%), (DIF) eclogitic-rutile (=high Al and Fe), (DIF) Kokchetav-like diatreme-turmaline, ?diatreme-staurolite (high Fe/Al and Ti/Si ratios) and (DIF) kimberlitic zircon (= high Si and Zr). The majority of the grains were picked in inferred volcaniclastics diamond-bearing sediments (KNP-01, KET-02) and/or in diamond-bearing loam-sample that cover inferred kimberlite pipe (KNP-02, KET-03, KET-04, KET-05, KET-06 and KET-07). Others grains were collected in alluvial samples.

In the Fig.-4 is shown some sharp to round edges-gem quality diamonds (colorless, fancy-pink, fancy-yellow, fancy-green) and industrial diamonds (translucent), that were separate from different exposed kimberlitic pipes anomalies (magmatic and/or inferred volcaniclastics kimberlite) and the soil that covers the pipes anomalies. Until the moment we were found 4 big diamonds (~1.0-~3.70 ct., Fig.-4), all collected next to KNP-01/KNP-02 (inferred volcaniclastics kimberlitic pipe). Over all, using (*Paraguayan*) work exploration method we were picked hundreds

small macro and micro diamonds from the inferred kimberlite pipe/kimberlite pipe anomaly (KEH-02, KET-02, KET-03, KET-04, KET-05, KET-06, KET-07, KPB-01, KCC-01, KYY-01).

Diggers (in one way) and (in other way) Dr. L. Rombouts (Rex Mining) found alluvial diamond in Paraguayan **RACB** portions next/neighbors to the frontier between Brazil and Argentina.

In introductory form it was calculated a reference geotherms for the now available kimberlitic mineral data; this is, the center-north Paraguay portion of the **RACB**: 36-42mW/m^2. For calculated the reference geotherms be used pyrope-almandine-grains (where the pressure (P) was estimated with base the Collerson et al., (2000) method and the temperature (T) was projected using the formula *T-c=1322.85 + (-783.8684*(MnO)* applicable only to G-3 garnet; both an empirical formula); as well as, selected picro-chromites and chromites-grains (where the T was calculate with the variant of TMg thermometer of Presser and Silva, 1997 ((T-c=*742,48+(26,8 X FeOc*)) and variation the of Doroshev's barometer (P-kbar=*Cr# X Cr2O3* content (Presser, 1998) for the P estimation). In this means, apparently the KIM/DIF form the center-north Paraguay portion of the **RACB** was pulled by the kimberlitic magma a more or less 220 Km of deep.

Consequently, is seen that the Rio Apá Cratonic Block as ideal target that could provide diamond-bearing kimberlites to they become into world-class diamond mines.

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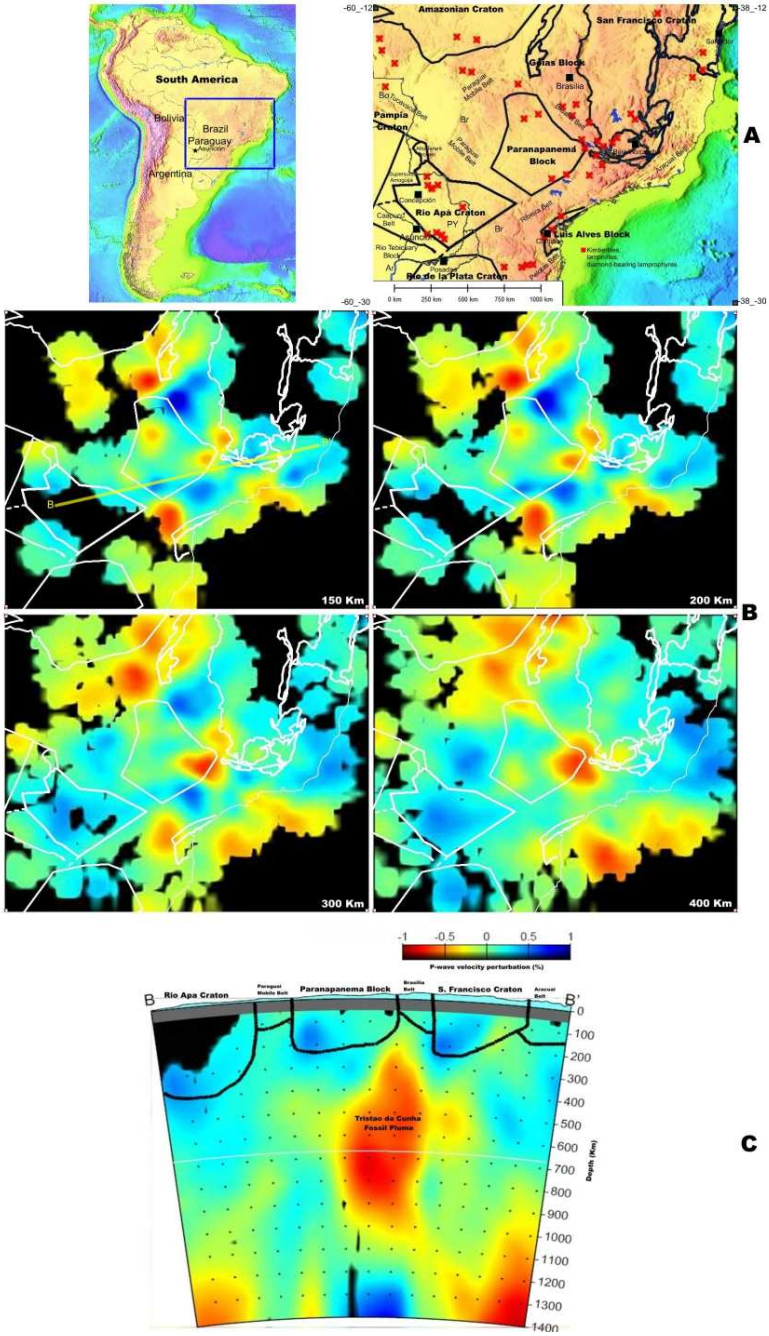

Fig.-1. The Rio Apá Cratonic block and related geologic provinces in P-wave seismic view. Horizontal map showing principal geologic provinces (in accordance with information available in http://www.cprm.gov.br/ and others) in **A;** and, tomographic image derived from P-wave seismic velocity perturbation data at depth of 150, 200, 300 and 400 km is showing in **B** (Rocha, 2003; see also, Assumpcao et at., 2004). Panels **C** are vertical cross section view of P-wave velocity perturbations, in agreement with B-B' profile of Rocha (2003)(=B-B' in 150 Km), where Cratonic root-profile is here interpretive. According this seismic information, the **RACB** lie in to high velocity region, and so indicating a relatively thicker and cooler **RACB**-lithosphere. In **A**, red character =kimberlite and related rocks; bold-thick line indicates the outermost boundary of the Achaean Cratonic block and bold-less-thick line indicates the outermost boundary of the post Achaean Cratonic block.

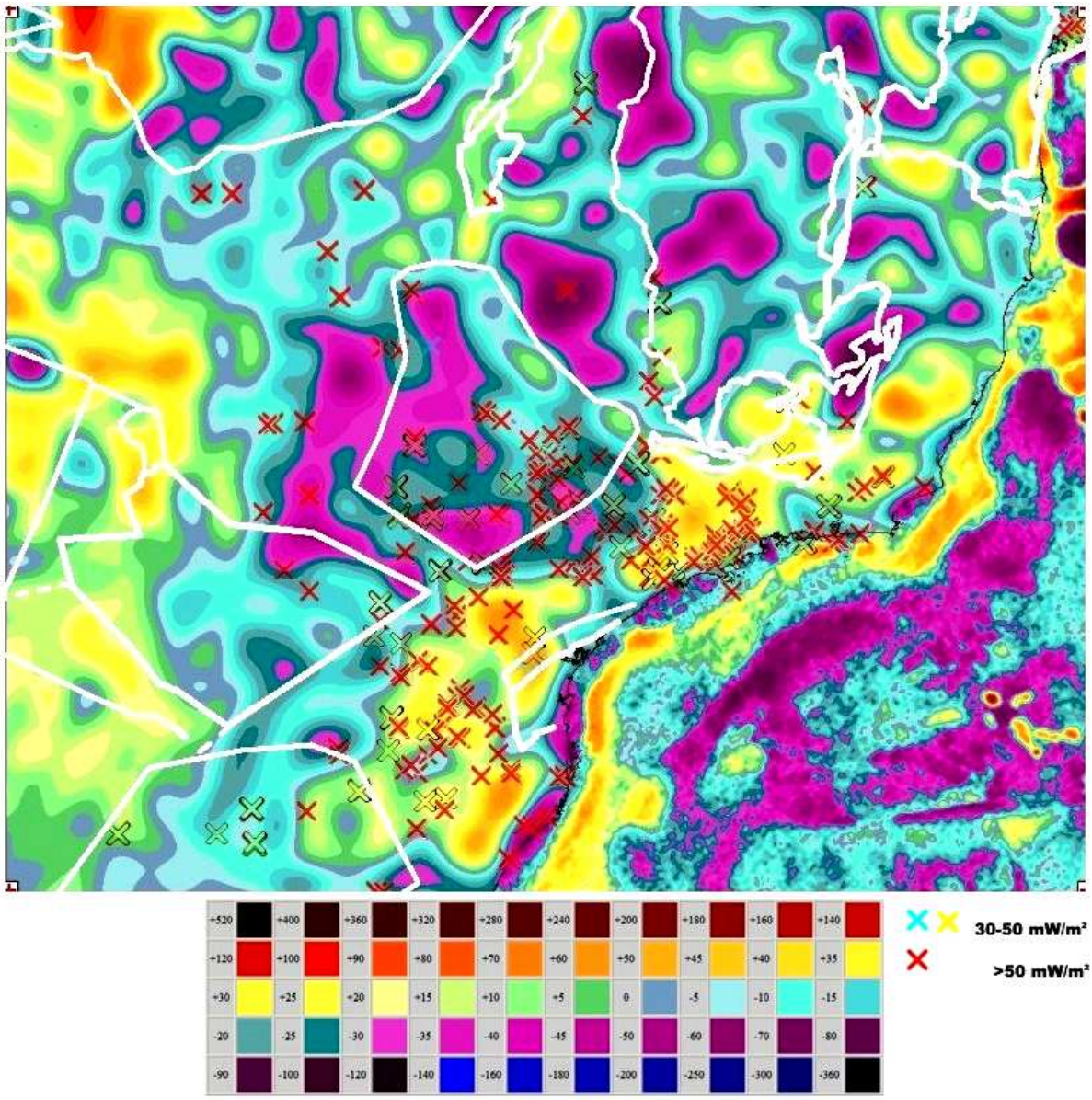

Fig.-2. The Rio Apá Cratonic block and related geologic provinces in marine gravimetric-data view with regional superficial heat flow-data. The principal geologic provinces are in accordance with **Fig.-1A**. The distribution of superficial heat flow = 30-50mW/m2 for the next to cratonic value, and >50mW/m2 for near no-Cratonic value. Comments are given in the text.

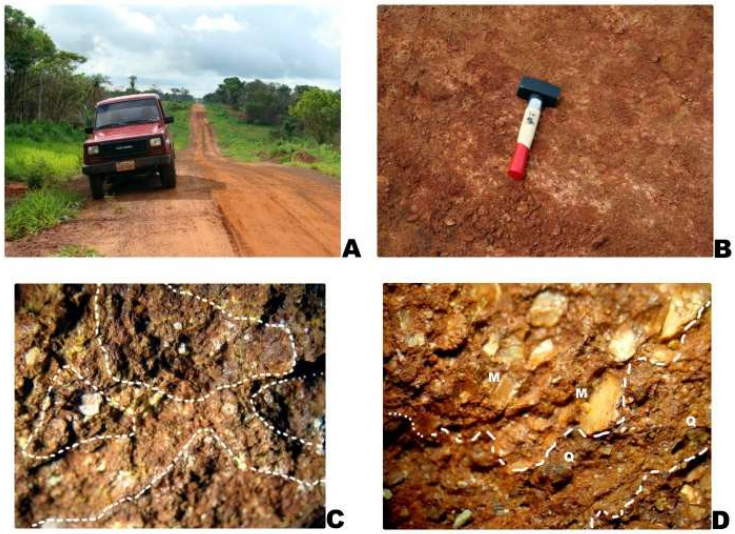

Fig.-3. The body KH-02, mica (pseudomorphed phlogopite) macrocryst-rich kimberlitic/orangeite breccia. Geologic country works give took to find (the 10/December/2003), to approximately 20 Km to the south frontier with Brazil (Col. J. F. Lopez, Dpto. Concepción - Paraguay), the KEH-02 kimberlitic/orangeite anomaly, it thanks to the identification a strong reddish contrasting soil (**A**). In this place it is exposed a completely weathered rock with red-blood tones (**B**); when the rock is examined with attention, they show kimberlitic juvenile angular fragment (rich in mica mega-crystals and ?olivine (totally pseudomorphed) mega/micro-crystals). The angular fragments are located in a matrix with the same composition that contains quartz (**C**). In **D** it is detailed the contact between a juvenile fragment (rock with abundant pseudomorphed phlogopite phenocrysts =***M***) and the matrix gives the same composition with abundant sedimentary quartz (***Q***). KH-02 mica macrocryst-rich kimberlitic/orangeite breccia is a diamond-bearing (=**Fig.-4 E**).

Fig.-4. Image of diamonds collected over center-north Paraguayan portion of the **RACB.** The plate showing well formed sharp (**C**, **F**, **G**, and **H**) to round-edges (**A**, **B**, **D** and **E**) octahedral crystal of macro-diamonds (**A** to **E**) and micro-diamonds (**F** to **H**). Dodecahedral diamond crystal showed in the plate **A** it is the biggest (~3.70 ct.) diamond up to now found in the Norte Puajhú (3 Km. next to the river Apá, frontier with the Brazil). Colorless diamonds: **A** (dodecahedral crystal), **B** and **F**; fancy-color diamonds: **A** (very light-yellow, with 2.65 ct., octahedral crystal), **C** (deep carmine red-pink), **D** (light-pink), **G** (light-green) and **H** (deep-pink); industrial: **E** (orange-brown).