DIAMONDS ASSOCIATED WITH THE PERMO-CARBONIFEROUS GLACIAL DEPOSITS IN THE PARANA BASIN, BRAZIL.

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The occurrence of diamods in the Parana Basin is known since last century and up to this moment their primary sources are not identified.

The Parana Basin covers an area of 1.600.000 Km^2 extending through Brazil (1.000.000 Km^2) Paraguay, Uruguay and Argentina. It represents the most important geological record of Gondwana Continent in South America.

Five cycles of flexural basining has accumulated and preserved packages of sediments 4 Km thick and basaltic volcanic rocks 2 Km thick, as representing five tectonosedimentary sequences limited by generalized unconformities globally correlated.

There are over ten diamond production sites related to quaternary gravel, recent placers and active stream sediments distributed mainly over permo-carboniferous glaciogenic sediments of Itarare Group. A genetic association of the diamonds with those sediments is suggested by several researchers. On the other hand some other researchers believe those mineralizations are associated with kimberlitic rocks, although works developed under this assumption have obtained no success so far.

The purpose of this work is the definition of the preferential facies of proglacial rocks that might host the diamonds and to discuss the occurrence and processes which promoted their transport and concentration.

The methodology used in this study comprised three steps: i)the analysis of the sedimentary facies; ii) the comparison of heavy minerals assemblage from a mineralised hydrographic micro-basin with the permo-carboniferous sediments; iii) the comparison of diamonds and satellites morphoscopic features from active sediments, placers and early glaciogenic sediments.

This paper deals with some results which have been achieved on the attempt of defining the secondary sources of diamonds in the Parana Basin.

Stratigraphic Setting: Parana Basin is an intracratonic basin-type (Gondwana Continent) whose basement is composed by a complex colision system of plates and microplates consolidated by the end of Late Proterozoic. The collapse of the orogenic belt was followed by post-orogenic local riftings of eopaleozoic age (520-470 M. y.). The thermal decay and stress relaxation at the Cambrio-Ordovician leads to the begining of cratonic sudsidence at the Late Ordovician.

The stratigraphic setting is represented by five tectono-sedimentary sequences separeted by interregional unconformities (Soares et alii, 1978) with tectonic indicators of extensional and compressional kinematics related, respectively, to the early phases and final phases of the sequences. Each of them constitutes the record of one tectonic cycle

individualized by a spreadout craton subsidence and consequent uplift with a minimum of sedimentation.

The Ordovician-Silurian Sequence is composed by basal conglomerates and continental sandstones followed by marine sandstones and glacial diamictites; upwards there are transgressive marine shales overlaid by regressive marine sandstones.

The Devonian-Mississipian Sequence is composed by psammitic/psephitic basal sediments which evolves to marine sediments upwards.

The Pensilvanian-Permian Sequence presents the most complete depositional record in Parana Basin. Permo-carboniferous glaciogenic sediments over 1000m thick, located in the lower half part of the sequence, are represented by diamictites, sandstones, siltstones and mudstones of Itarare Group.

According to França and Potter (1988) the Itarare Group represents three depositional cycles where continental marine, glacial marine, glacial and fluvial environments are prevailing. Soares (1992) identified at least four regional glacial cycles; the first is associated to continental deposits related to the deposition of conglomerates, sandstones, siltstones and diamictites on striated paviments (lodgment till). Those sandstones where formed by the combination of outwash, braided rivers and fan delta environments. The last cyclo is associated to continental chanel gravels, sandstones and extensive diamictites, overlying coastal deposits with coal. The middle ones are associated to marine transgressive shales and deepwater ressedimentated sandstones. The lower and upper continental sediments are the source rocks for mineralized alluvions.

Discussion: The most important diamantifeous sites of Parana Basin are located in its eastern part (Tibagi, Telemaco Borba, Cinzas river, Peixe river and Verde river), in the northeastern (Franca), western (Coxim river and Taquari river) and northwestern part (Piranhas river, Araguainha river, Garças river, Caiapo river and Claro river).

The diamonds mineralizations are found in hydrographic basins where devonian, permo-carboniferous and permian stratigraphic unities crop out. The diamonds are recovered from high terraces, low terraces and from active stream sediments. Some rivers from the eastern border have their catchment areas located in pre-cambrian terrain, but the diamond occurrences are exclusively related to the areas where the rivers cross sedimentary rocks. The mineralizations that are found in devonian unities normally present contribution from the sediments of Itarare Group.

In the eastern part of the basin, diamantiferous placers occur mainly associated to barriers produced by diabase dikes. Some researches believe that diamonds primary sources can be related to those intrusive bodies. However, the heavy mineral assemblage analisys (magnetite ilmenite, spinels and/or garnet and secundarity, gold, zircon, chromite, pyroxene, hornblende, tourmaline, rutile, leucoxene, anatase, apatite among others) in combination with geophysic data were not conclusive in the identification of primary sources indicators.

There is gold, either as spots or galls, associated to diamonds in Tibagi and Telemaco Borba sites, where the distribution of the gems is concentrated in the smallest sizes (0,10 $c.st^{-1}$); there are stones around 0,30 $c.st^{-1}$ and rarely, they are about 9,0 $c.st^{-1}$ The main characteristics of them are polished surfaces and tetrahexahedroid forms. The association of the mentioned gold and diamonds characteristics indicates that the transport

was not effective in the selection of densities and sizes, by one hand, but it was indeed in the breaking, erosion and polishing. This could mean a multiplicity of short cycles of glacial alternate with stream transport.

The studied Santa Rosa site shows a mineralised drainage basin where the erosional area is located over basal and upper continental conglomerates of Itarare Group. There isn't any known occurrence of dikes in that area.

According to Svisero (1979), the chemical composition of Tibagi diamond inclusions shows similarity to the ones found in kimberlites of Afrika and Siberia

Striated surfaces and clasts orientation of glacial sediments at the oriental border of Parana Basin indicate an ice flow toward NNW. Other paleocurrents indicators suggest that there were three main glacial lobes going to the basin during the Carboniferous-Permian: i) at the east border the Kaokoveld-Parana lobe, coming from Afrika; ii) the Santa Catarina-Assunção lobe, coming from Southwest; iii) at the occidental side of the basin, the Mato Grosso lobe coming from NW (França and Potter, 1988).

Conclusion: The diamantiferous alluvions of Parana Basin lay preferently over the permo-carboniferous sedimentary rocks of Itarare Group.

Primary sources of the diamonds or any indication of its proximity, as the presence of satellite minerals, e.g., is not known so far.

The diamonds and the gold associated characteristics indicate several cycles of transport, consisting of grinding, selection and polishing, what is better explanned by glacial transport and outwash.

The lower and upper continental sediments of Itarare Group are the source rocks for the mineralized alluvions.

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