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KAOLIN SITUATION IN BRAZIL
AND
THE ROLE OF R AND D CENTERS*

by

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P A R T 1

KAOLIN STITUATION IN BRAZIL AND THE ROLE OF R AND D CENTERS

1. INTRODUCTION

Kaolin is the name of a mineral product originated from the weathering or hydrothermal decomposition of feldspatic rocks. The clay-minerals present are caulinite and or Halloysite,both hydrated aluminium silacates.

Kaolin is a multiple industrial application raw-material,being the most important the use as inert filler and coating in the paper industry and a component in whiteware ceramic bodies and many other applications,in small quantities, use the Kaolin due to its coating capacity or as an inert filler or inorganic absorbent.

Brazilian reserves (1986) attained 825 million tons, located in Amapá (30,5%), Santa Catarina (1,7%), Minas Gerais (1,3%), Pará (28,8%) and São Paulo (34,6%). The Braziliam production (86) was 1,201,500 tones of crude Kaolin and 500,000 tones of beneficiated product, coming in their most part from Amapá, Minas Gerais and São Paulo.

2. GENERAL INFORMATION ON KAOLIN

Kaolinite and related clay minerals are formed by weathering or by hydrothermal alterations of preexisting silicate rocks. Weathering is the most common and it occurs by the action of surface acid solutions in tropical regions (warm, humid and woody) where feldspars and felsdpatic rocks are decomposed into Kaolinite by the leaching of silica and of alcalis and alcaline-earths, according to the following reaction:

$$4KAlSi_3O_8 + 4H_2O + 2CO_2 \longrightarrow Al_4(Si_4O_{10})(OH)_8 + 2SiO_2 + 2KCO_3$$

Orthoclase water Kaolinite Soluble Soluble

The chemical mechanism of hidrothermal reactions are similar to those of weathering, the difference being the magmatic origin and the very hot solutions. As a general rule, hydrothermal reactions occurs in cold climate regions.

Kaolins originated from pegmatite rocks have higher purity than those from granitic rocks. Good Kaolins come from temperate regions, like from Kao Ling in China, where from comes the name of the claymineral and of the rock.

2.2 Types of Kaolin Deposits

According to their genesis, Kaolin deposits are classified into hydrothermal or weathering types, according to the rock; they can also be residual or sedimentary, with specific characteristics, but all of them economically important, according to the region of occurence.

2.3 Prospecting

Kaolin is easely recognized by its white colour, brittleness and dust-forming easiness and can be found associated to feldspars and micas in residual pegmatite deposits and to quartz in weathering deposits. In both cases, it goes in depth gradually to the parent rock.

2.4 Exploitation

Kaolin exploitation does not need the use of explosives. Depending on the deposit conditions, production volume and treatment techniques, the exploitation can be done by hand tools, mechanical tools (shovels, draglines, moto-scrapers, etc or by hydraulic dismounting, that uses large mud pumps to collect Kaolin slurry.

2.5 Processing

Kaolin processing aims to remove impurities such as quartz, micas, iron and titanium oxides, etc. Coarse grain impurities can be removed by sieving and/or cycloning. Chemical impurities are removed by chemical processes. To remove coarse grain impurities both dry or wet method can be used. The dry method includes such basic operations like drying, grinding, screening or pneumatic separation. The wet method is more expensive and complex, but is widely used due to higher quality product.

In Brazil, the wet method is widely used, but greatly simplified. It consists in the Kaolin dispersion in water, a sequence of screening to remove quartz and mica and finally filterpressing. This is the usual ceramic grade Kaolin and it is supposed to be finer than 200 mesh or 325 mesh. The paper filler grade, besides screening, includes hidrocycloning after 200 mesh and 300 mesh screening, followed by a final multi-hydrocycloning. The dewatering is by filterpressing and drying (flash drying, owen drying, hot plate drying, rotary kiln drying etc). In few plants, before dewatering, leaching, with sulphuric acid and sodium ditionite or hydrossulphide, is done to remove iron and or titanium oxides.

3. USES AND SPECIFICATIONS

Kaolin has many industrial applications due to its natural and after firing white colour, fine particles, softness, chemical stability and typical particle shapes (hexagonal plates in Kaolinite or tubular forms in halloysite).

Traditionnally, Kaolin is used in paper filling and coating, ceramics, paints, rubbers and plastics. It has many other minor but not less important uses, such as in:fertilizers, pharmaceuticals, glass (fiber glass), insulators, friction materials, agricultural defensives, cosmetics, animal feed, lead pencil, welding electrodes.

3.1. Paper

In the paper industry, Kaolin is used as filler or coating. Almost all of papers types contain Kaolin between 5% to 3,5% of the cellulose fibers weight.

As a filler, Kaolin is used in papers to improve the following properties:

- **Opacity:** because cellulose fibers are translucent;
- **Colour :** Kaolin must not compete with the whiteness of leached fibers;
- **Printing easiness:** the filler improve the local printing ink absortion, limiting its difusion;
- **Softness and flexibility:** sometimes cellulose fibers are not so flexible; and
- **Specific gravity.**

In Brazil, it is used as filler, Kaolin with particle size 60% below two microns and whiteness of 75°GE.

The paper coating improves such properties as printing easiness, opacity, brightness, whiteness and smoothness.

The Koaling coating capacity comes from its specific particle shapes (hexagonal plates), the presence of halloysite (tubes) being harmfull In high speed coating machines, the smectite/

/contamination of Kaolin is also harmfull due to the increasing of the suspension viscosity.

Two properties are very important in paper coating Kaolins: particle size distribution and whiteness.

For many years, Great Britain and United States of America owned the exlusive production of paper coating Kaolins. After 1977, Brazil started the production of a paper coating Kaolin, named "Amazon 88", whose basic specifications are:

- Particle size distribution: 96% < 2µm, 94% < 1µm and 70% < 0,5µm, and
- Whiteness TAPPI: 87,7%.

"Amazon 88" is quite well accepted all over the world.

3.2 Ceramics

Kaolin is a basic component in almost every traditional white body ceramic procuct; the quantity used in such a body can vary from 10% to 40% in weight. It is used in stoneware, fãiance, porcelain, sanitary ware, wall tiles, etc...

For this case the iron, manganese and titanium content must be low. If the after firing colour is not so white and it the and titanium content are below 0,5% and 2,0% respectively, the Kaolin can be used in the refratary industry. In frit production, the Fe_2O_3 content must be below 0,08%.

3.3 Paints

The good coating properties comes from the typical shapes form of Kaolinite particles. Also, Kaolin is used as suspending and diluting agent in oil-base paints. For this purpose, it is used a Kaolin of such specification as: particle size below 325 mesh, white colour, calcium free, oil absortion 38%, minimum and moisture 1%, maximum.

3.4 Rubbers

Clays and Kaolins are widely used in vulcanized rubber due to their low cost and white colour which allow the use with coloured pigments. Some Kaolins can provide high modulus, good abrasion resistance and stiffness to vulcanized rubber. "Hard" and "soft" Kaolins, according to their mineralogical compositions, provide specific properties to rubber products and the safer method to evaluate the propers type and conditions is to apply specific technological test in the vulcanized rubber.

In Brazil, both imported and local Kaolins are used. In the tire industries, 97% of the total used are local Kaolin, and in the other rubber industries, 30% of total are imported Kaolins.

In the Brasilian rubber industry the following properties or characteristics are used for local and imported Kaolin.

	LOCAL	IMPORTED
SiO_2	42% to 48%	52,8%
Al_2O_3	34% to 40%	44,8%
Fe_2O_3	2% (max.)	0,3%
TiO_2	-	1,4%
Na_2O	-	0,1%
pH	6,5 to 7,5	5 to 5,5
Moisture (110°C)	1%	-
Loss on ignition	13%	0,7%
Brightness	-	85% to 87%
Oil absortion	-	0,5%
Particle size	0,2% Residue on 325 mesh	68% below 2µm

3.5 Plastics

In the same way as rubbers, the plastic industry uses Kaolin as reinforcing filler. Specifications are similar to those

of the rubber industry. Both local and imported Kaolin are used.

3.6 Pharmaceuticals

Kaolin is mostly used in pills or supension of anti diarrhoeic medicines for human and veterinary purposes.

For this purpose the Kaolin has to have the following specifications:

- Lead: free (max. 0,01%);
- Iron carbonate: free;
- Acid soluble substances: 2% (max);
- Loss on ignition: 13% (max);
- pH: 4,5 to 6,0; and
- Part (7,5) of pharmaceutical Kaolin is imported.

3.7 Fertilizer

In the fertilizer industry Kaolin is used as binder and coating of nitrogen rich fertilizers. Usually a 15% residue in 325 mesh is acceptable.

3.8 Glass Industry

For the fiber glass industry, Kaolin has to present the following characteristics:

- Al_2O_3 : 38% (min);
- SiO_2 : 46,3% (max);
- Fe_2O_3 : 0,8% (max);
- Moisture : 0,5%;
- Loss on ignition: 14,5%; e
- Particle size : 100% below 65 mesh and 3% below 325 mesh.

3.9 Abrasives

Kaolin is used in the vitrified ceramic body binding the abrasive grains. The usual specifications are the following:

SiO_2:43,4%; Al_2O_3:39,3%; Fe_2O_3:0,9% (max); TiO_2:0,1%;CaO: :1,0%; MgO:1,2%; K_2O+Na_2O:0,7%; loss on ignition: 13,4 %; particle size:98% below 200 mesh.

3.10 Agriculture

Kaolin is used as inert powder in insecticides and herbicides due to the high coating power of Kaolinite particles. A 325 mesh powder is used with 2% moisture (max) and pH 5.

3.11 Other Uses

Also, in small amounts, Kaolin is used in:

- Insulating cements and asphaltic emulsions, as filler;
- Friction materials, as filler;
- Welding electrodes, as filler and slag forming agent;
- Cosmetics, as pigment carrier and absorbent;
- Soaps and detergents, as filler;
- animal feed, as filler and binder;
- Ceramic fibers, as SiO_2 supplier; and
- Pencils, in the lead composition together with talc.

4. PRODUCTION

The 1986 world production of Kaolin was around 24.5 million tons, and Brazilian contribution was 2.5% of this total.

In TABLE 1 is shown the growth of the Brazilian Koalin production: the raw production in 1986 was of 2.2 million tons and the production of beneficiated Kaolin was of 533,000 tons, an 8% growth comparing with 1985. In 1986, Brazil imported a total of 773 tons at a price CIF, of US$ 313.776 and exported a total of 204.105 tones at a price FOB of US$19.5 million. The local consumption was 330.468 tons.

Important to observe are the prices of per kilo imported (US$406) and exported (US$ 86) Kaolins. The imported Kaolin costs 4.7 times more than the exported one.

In TABLES 2 and 3 is shown a list of the main mines and their classification by regions and classes of production volume. In the map. FIGURE 1, can be seen the location of the known Kaolin deposits in Brazil. These deposits are concentrated in a distant range around 100km along the Atlantic Coast and they are mainly of pegmatite oring. Some (Amapá, Pará, São Paulo and perhaps Santa Catarina) are sedimentary Kaolins.

5. NEW TECHNOLOGIES

It is difficult to speak about new technologies about Kaolins in Brazil.

There is a big company, named Caulim da Amazonia S/A - CADAM, founded by Dr. Ludwig and now owned by Brazilian groups. It is supposed that this company has quite modern technology and industrial facilities. There is also, a medium size company, English China Clay(ECC) exploring and bleaching Kaolin in São Paulo State and selling it as paper filler. The CADAM Kaolin is sold dryed, powered and bagged; the ECC Kaolin is sold as slurry in tank trucks. The other mining companies are medium to small size; some of them (5) prepare Kaolin to be used as paper filler and ceramic raw material and some prepare Kaolin for ceramic use only. There are also small companies making special Kaolins(calcined, delaminated, etc) for special uses.

Probably there is no special technology in the Kaolin industry in Brazil. What can be observed is some effort to produce higher grade Kaolins trying to indroduce technologies (in the exploitation fields) already available all over the world.

Technological studies focussed mainly in ceramic application but some of them, done with electron microscopy, studied the presence and influence of halloysite in specific uses as filler or reinforcement in rubber and plastic.

6. QUARTZ, FELDSPAR AND MICA

It is not usual to explore these Kaolin associated minerals in Brazil, due to their abundance and high grade in specific deposits.

There were informations about the beneficiation of high grade quartz (exported) in a Kaolin mine near São Paulo. Today this quartz beneficiation ceased.

In the State of Minas Gerais, in a pegmatite Kaolin mine, large mica plates are explored and exported to be used as electrical insulators.

The Department of Mines of the Universtity of São Paulo developed flotation studies to separate mica, feldspar and quartz, all of high grade, however with of to high coast to compete with natural minerals.

TABLE 1 - Some statistical data on Kaolin in Brazil

			1981	1982	1983	1984	1985	1986
PRODUCTION	RAW	(t)	1.063.480	1.930.863	1.241.252	1.569.063	2.156.878	2.196.256
	BENEFICIATED	(t)	469.757	418.120	486.359	486.359	524.182	533.800
IMPORTATION		(t)	2.933	2.045	1.975	1.369	1.281	773
		(US$-CIF)	1.203	883.000	880.233	650.000	630.000	313.776
EXPORTATION		(t)	133.778	166.532	181.554	195.829	196.402	204.105
		(US$-FOB)	11.915	18.795	17.641.375	19.651.000	18.673.306	19.594.080
CONSUMPTION		(t)	388.912	253.735	240.541	291.899	329.061	330.468
MEDIUM PRICES	IMPORTED	(US$/t-CIF)	410	431	446	475	493	406
	EXPORTED	(US$/t-FOB)	89	94	94	100	95	86

SUMÁRIO MINERAL : 1987 (DNPM-MME, Brasília, DF, V.7 (1987).

FONTES : DNPM-DEM, CACEX e CIEF

TABLE 2 - Mining Companies by Region and Class

EMPRESA	LOCATION	STATE	CLASS
aulim da Amazônia S/A	Mazacão	Amapá	C
npresa de Mineração Horii Ltda (1/2)	Mogi das Cruzes	São Paulo	C
rmãos Guilhermino Ltda	Braz Pires	Minas Gerais	F
aolim Azzi Ltda	Mar de Espanha	Minas Gerais	G
ineração Anasteve Ltda	Bicas	Minas Gerais	H
CC do Brasil Mineração Limitada (1/2)	Mogi das Cruzes	São Paulo	E
npresa de Caolim S/A (1/2)	Espera Feliz	Minas Gerais	G
CC do Brasil Mineral	Mogi das Cruzes	São Paulo	G
npresa de Caolim S/A (2/2)	Inhaúma	Minas Gerais	H
npresa de Mineração Morita S/A	Registro	São Paulo	G
aulisa Indústria de Caulim S/A	Junco do Seridó	Paraíba	H
ociedade Caulinita Ltda	Itapecirica da Serra	São Paulo	H
erâmica Indústria Cerâmica e Mineração (1/2)	Suzano	São Paulo	H
erâmica Indústria Cerâmica e Mineração (2/2)	Suzano	São Paulo	H
npresa de Mineração Horii Limitada (2/2)	Mogi das Cruzes	São Paulo	H

SP : US$ 53.675x10^3

DMB : 0,76%

ines Distribution in Brazil: Amapá : 1 = 1C
Minas Gerais: 5 = 1F+2G+2H
Paraíba : 1 = 1H
São Paulo : 8 = 1C+1E+2G+4H

OTAL OF MINES : 15

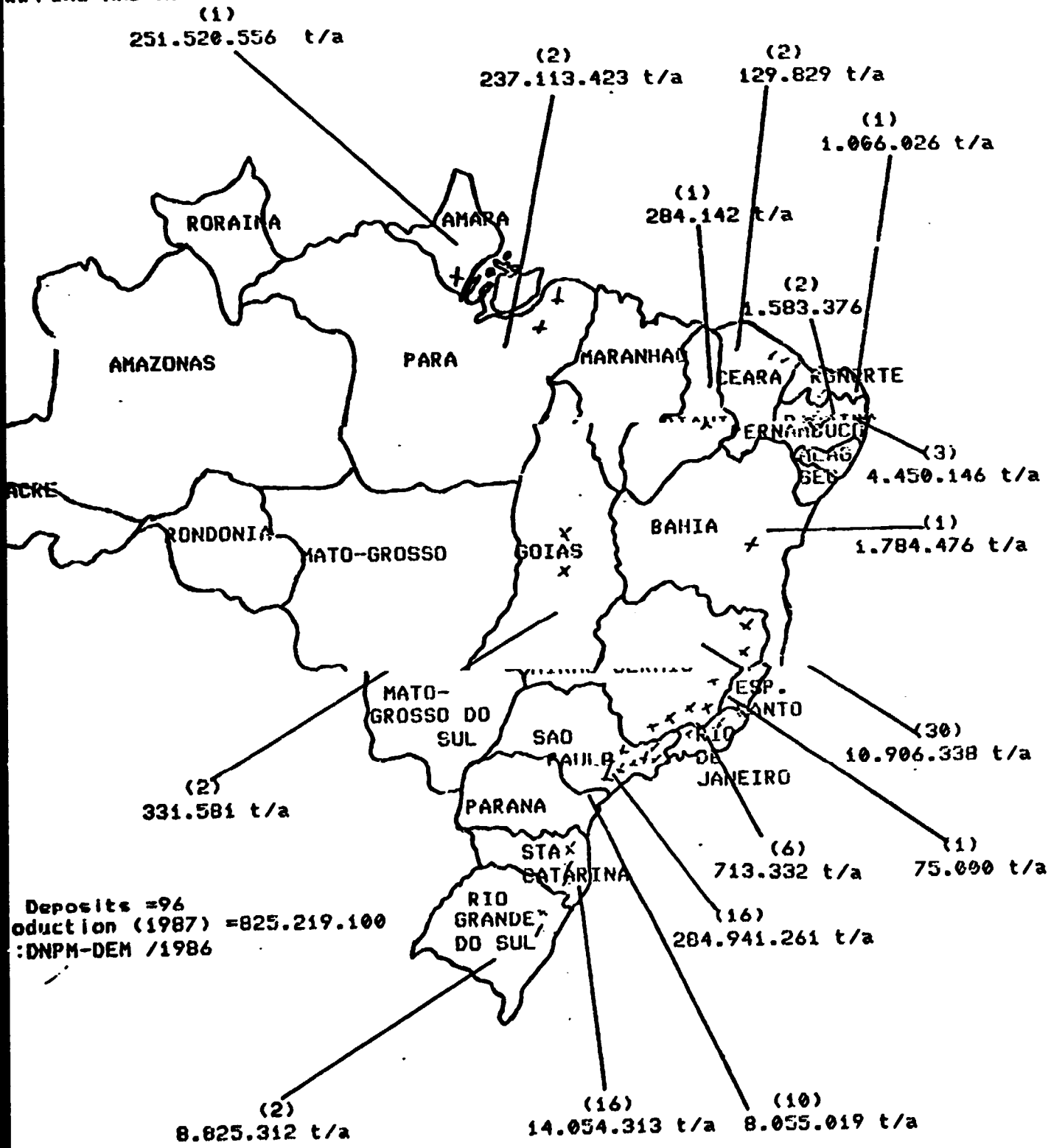
OTAL OF COMPANIES : 11

TABLE 3 - Classification of Mines by Production

PRODUCTION \ CLASSIFICATION	A	B	C	D	E	F	G	H	TOTAL
Higher than 3000.000 T/Y	-	-	-	-	-	-	-	-	-
1.000.000 to 3.000.000 T/Y	-	-	-	-	-	-	-	-	-
500.000 to 1.000.000 T/Y	-	-	2	-	-	-	-	-	2
300.000 to 500.000 T/Y	-	-	-	-	-	-	-	-	-
150.000 to 300.000 T/Y	-	-	-	-	1	-	-	-	1
100.000 to 150.000 T/Y	-	-	-	-	-	1	-	-	1
50.000 to 100.000 T/Y	-	-	-	-	-	-	4	-	4
20.000 to 50.000 T/Y	-	-	-	-	-	-	-	7	7
									15

BRAZIL

MAPPING AND NUMBER OF KAOLIN MAIN DEPOSITS AND PRODUCTION BY STATE



Deposits =96
oduction (1987) =825.219.100
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P A R T 2

ROLE OF MINERAL RESEARCH CENTERS

Instead of analysing and discussing this item in a general point of view, it is preferrable to present the Research Institution were I work for more than 23 years and show the mecanisms this Institution uses to increase and strengthen relations with other similar Institutions and even other countries.

1. IPT DESCRIPTION

I belong to Technological Research Institute of the State of São Paulo, Brazil (Instituto de Pesquisas Tecnológicas do Estado de São Paulo, S/A) locally known as IPT, from its initials in Portuguese.

Nowadays, IPT is divided in 18 Divisions or Technical Centers, as follous (TABLE 1):

- Information and Systems Analysis Division;
- Economy and Engineering Systems Division;
- Building Research Division;
- Industrial Electricity Division;
- Civil Engineering Division;
- Mechanical Engineering Division;
- Ship and Ocean Research Division;
- Wood Division;
- Metallurgy Division;
- Mining and Applied Geology Division;
- Chemistry and Chemical Engineering Division;
- Mineral Dressing Division;
- Pulp and Paper Center;
- Railway Development Center;

- Fertilizers Center;
- Textile Center;
- Industrial Equipament Technology Center;
- Center for Leather and Footware; and
- Metal processing by Explosives.

Some relevant figures about IPT:

- Personal:2.100, Professional: 760, Technicians: 670,and support staff: 670;
- Budget: 35 million US$/year; and
- Source of income: Contract research: 20 million US$ and state funds 15 million US$ (TABLE 2).

The IPT main activities are (TABLE 3):

- Technical and economical feasability studies;
- Produce and process development;
- Target research and trouble shooting;
- Standards and quality assurance; and
- Human resouce development.

The IPT main programs are (TABLE 4):

- Technological Information:
- Basic Industry Technology - Quality assurance;
- Instrumentation;
- Biotechnology;
- Informatics and Industrial Automation;
- New Materials;
- Energy;
- Iron and Steel Technology; and
- Housing.

Some recent exemples of projects carried out by IPT (TABLE5):

- Calcium - silicium injection equipment for desulfuration of high-grade steel;
- Bio-digestion of stillage from etanol plants;
- Potential of Biomass utilization for energy purposes;
- Micro distillery for alcohol production;
- Survey of the mineral resources of the state of São Paulo;
- Ofshore structures;
- Vessels and port activities from the Amazon region;
- Concrete pre-fab building for public uses;
- Energy conservation: Ceramics, cement, pulps and paper, textiles, glass, fertilizer industries;
- Light aggregate from sewage sludge;
- Specification and procurement of 3 million cross ties for the Carajás Railway;
- Thermo-mechanical pulp from fast growing species;
- Technical support for heavy clay industry of the State of São Paulo;
- Plasma torch for ghe steel industry;
- Computer aided design software for brazilian-made microcomputers;
- Treatment of residue effluents from brewries and soy bean industrial processing plants by anaerobic digestion;
- Nationalization of fire-fighting equipment;
- Bio-gas and organo-mineral fertilizer production from digested sewage sludge;
- Upgrading and maintenance of dirt roads; and
- Geotechnical map of greater São Paulo.

2. IPT COORDINATION FOR INTERNATION RELATIONS - CINT

In order to provide support to the increasing requests from institutions of developing countries for technical assistance, IPT established in 1981 a special office to coordinate the institute's international relations - CINT. Since its creation this office has received significant backing from the Brazilian System of Technical Cooperation, which consists of departments of the Foreign Relations Ministry and of the Planning Ministry.

Under the auspices of the Brazilian Government, a number of technical missions have been sent to American and African countries and a few projects have been initiated. One of them, which also counts on financial support from the United Nations Industrial Development Organization - UNIDO, is being carried out together with the Kenya Industrial Research and Development Institute - KIRDI, in the area of microplants for ethanol production from sugar cane.

CINT also coordinates technical cooperation programs offered by developed countries to IPT. Although in the recent past cooperation programs from the United States and from some European nations have been important to the strenghening of IPT's capabilities in selected areas. Currently Japan is the only country to provide the Institute with technical assistance programs.

As an exemple of IPT/JICA cooperation has been runned at IPT and held by IPT professionals an "International Training Course on Ceramic Technology" destinated to portuguese and spanish speaking South American professionals with a minimum 3 year experience in research or teaching in Ceramics. The duration of this course was 75 five 8h/days.

3. INTERNATIONAL INTERCHANGE PROGRAMS

The establishment of mutual interest program of information exchange and cooperation in scientific and technological activities is usually done between IPT and smilar R and D. institution, according to government rules and supported by each government rules. The financial support can also be done by some UN Organization or any other accepted by involve countries.

The OBJECTIVES of the so called PROTOCOL is to define the terms of a mutual collaboration program having as its ultimate goal the technological development resulting from the study and implementation of joint projects for transfer, adaptation and creation of technologies and technological services in areas for mutual interese.

The MODES of cooperation can be the following:

- Exchange of scientific and technological experiences;
- Exchange of scientific and tecnological information;
- Exchange of scientists, researchers and technicians;
- Joint research and development projects;
- Development of human resources;
- Courses, symposiums, scientific and technical meetings;
- Mutual consultation on subjetcs related to policies for the development of the science technology; and
- Dissemination of technical information available in both Countries on selected subjects related to the above PROTOCOL.

Any activity or service carried out under such PROTOCOL shall have its conditions defined trough a specific document designed as AGREEMENT.

4. IPT LABORATORY FACILITIES

IPT has available very good laboratory facilities for R and D and routine work on Kaolin and other non-metallic minerals.

At he Chemistry and Chemical Engineering Division, is available a complete Instrumental Chemical Analysis Center; the Inorganic Technology Group with its Ceramic Section and Non-Metallic Minerals Section; the Petrology and Prospecting Groups of the Mining and Applied Geology Division; The Ore Dressing Division; the Pulp and Paper Center, many other laboratories for specific test regarding industrial uses of non-metallic minerals and complete facilities for mineralogical and chemical characterization.

Economic aspects marketing and economic viability can be studied at the Economy and Engnnering Systems Division.

P A R T 3

MARKETING AND INTERNATIONAL DISTRIBUTION OF KAOLIN

1. EXISTING MECHANISMS FOR MARKETING AND DISTRIBUTION OF KAOLIN

For this type of mineral good, the prices tend to be negotiated directly among users and producers and tend to be stable for long periods according to basic costs plus some acceptable return tax.

Sometimes, sudden prices oscilations can accur, but the consumer cannot promptly move to a new supplier due to the extra cost involved (process modification, shipment, delivering therm,etc) This mechanism is quite different of the metallic commodity market which is carefully stablished and standardized in the various degrees of the primary metal. This standardization alow the metallic commodities to be marketed in many beneficiation grades in a very active and prices controlled market.

Under this focous have no great flexibility in marketing their products. In Brazil, there is a big size company, CADAM, founded by an american group. Maybe by that it was able to place its products in the international market. CADAM sells the "Amazon 88" bagged to be used as paper coating. There is also in Brazil, a medium size mining company, Enghish China Clay (ECC), located in the State of São Paulo, mining and producing paper filler grade Kaolin, sold as slurry, to local paper industries. There is no exportation by ECC.

In Brazil, there are no official mechanisms for marketing and distribution of Kaolin in the local and even in the international market. Arrangements are made by producers and consumers.

2. OBSTACLES

Well known there are three big Kaolin Companies in the world: English China clay (United Kingdon) and Georgia Kaolin (USA) and the Rubber Corporation (USA). They dominate the "how to produce" and "How to use" technologies and have some kind of controll of the international market.

In Brazil, Kaolin is imported for specific uses: rubber, plastics, pharmaceuticals, cosmetics, chemical industries, etc. The consumers of those Kaolins, that use also local Koalins, usually do not give the specifications needed. By this way, the Brazilian small and medium size producers don't know how to prepare conveniently their Kaolins and so the importations are justified.

Many times, an industry stablished in Brazil usualy imports Kaolin from its foreign "mother" (which is not a Kaolin producer), just to guarantee quality and process controll.

Most of local Kaolin mining companies are small and can't export. ECC may be an exception for the next future. Some large Companies, like Caulim da Amazônia S/A are making investment in the Kaolin production, including bleaching and they can become large producers.

Small groups, preparing special Kaolins (calcined, delaminated, etc.) are making effort to improve the quality and increasy the quantity of their production.

3. COOPERATION AMONG COUTRIES

The question is: to cooperate to change what? In the "International Training Course on Ceramic Technology" runned by IPT, with JICA support, it was evident the precariousness of South American economies. It is possible to change agricultural products and mineral commodities, but this does not promote any income distribution. South Americam markets are small and slowly expanding. For instance, Korea with its 43 million people is a very interesting market for Japan instead of Brazil with its 130 million inhabitants.

UNIDO would support:

- Human resources training programa;
- The creation of embryonary research centers;
- Interchange research programs;
- Researchers interchange;
- Research studies to define Kaolin specifications for different uses and the supply of samples of these Kaolins; and
- Courses and seminars to promote the interchange of knowledge and experiences.

4. FINAL NOTE

The above considerations were obtained during many years of working with Kaolin and came from many different sources as consumers, samall producers, technical associations, suppliers, etc.; therefor they are not systematic. Accidentally, other informations may exist but they are not available, being industrial or commercial secrets.