

CHAPTER VI CONCLUSION AND RECOMMENDATION

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Investigation for the development of the Ribeira area was made with emphasis on the following four points: (1) Drafting the development plan for mining and dressing of the new deposit discovered in the Perau area, (2) Organization of infrastructure associated with the development, (3) Evaluation of mine development in relation to the development of the new deposit, and (4) Redevelopment of the mines under operation in the Ribeira area.

(1) Conclusion

1) Mine Development

Mining of the new deposit was planned for operation based on assumptions such as a mine life of 10 years, an annual production of crude ore of 90,000 tons (7,500 tons/month) and a vertical shaft transportation system.

Dressing was planned for differential flotation of lead, zinc and barite. All the tailings will be deposited in the tailings pond for the purpose of prevention of environmental pollution.

2) Organization of Infrastructure

Investigation and design were made into details of the plan for transportation, water, electric power, manpower and mine camp site.

3) Overall Evaluation

The economical analysis showed that the development of the new deposit is advantageous for the economy of Brazil even if the international metal price in concentrate produced goes down by 10 % from current levels. This leads to the conclusion that the development plan should proceed. However, as shown by the financial analysis, it cannot be said that the private sector will invest in the development of the mine, unless the metallic price of concentrates goes up by 20 % of current prices.

4) Promotion of Five Mines under Operation

The investigation showed, all the mines to be behind in exploration. Few mines are operating a systematic method of mining, leading to low efficiency.

(2) Recommendation

1) Mine Development

Because of many uncertainties in respect to the ore reserve of the new deposit at Perau, it is necessary to plan fill-in drilling between the existing holes at intervals of 30 to 50 m in order to accurately estimate the ore reserve.

Since the new deposit is emplaced at a depth of 150 to 300 m below the surface, a vertical shaft is planned for the exploitation. This seems to be the most suitable method for development of the strata-bound deposit in the deeper part, although it is a little expensive.

Mechanization in exploration, mining and haulage is confined to the least amount because of a relatively cheap labor to mining cost.

Although gravity dressing would be applicable to the ore of the new deposit, the differential flotation method was adopted to recover the concentrates of lead, zinc and barite because of the low recovery rate of the former. It will be necessary to make an additional dressing test, using the drill cores, when drilling for confirmation of ore reserves is carried out.

Because the new deposit is emplaced in limestone terrain, the pH of underground water is about seven and the heavy metals content is low. It will be the same as the waste water from the dressing plant. However, a tailings pond must be provided because the waste water contains some cyanide which is used as a flotation depressor.

2) Organization of Infrastructure

Roads in the Ribeira area are mostly unpaved, and many areas are behind in development of electric power and communication. Therefore, organization of the infrastructure will serve to further other industries and will greatly profit local residents.

Mining and dressing operations of the new deposit will require a manpower of 150 to 200, which will benefit nearly 1,000 people if families are included.

The rate of unemployment is increasing in the area because of declining mining operations. The income of municipalities in the area largely depends on the mine product tax. Therefore, development of the new deposit will greatly contribute to the improvement of life of local residents.

3) Evaluation of Mine Development

It is regrettable that the financial analysis for mine development is not so satisfactory. For nonferrous metals, the Government should encourage the private sectors to tender for development by taking measures such as refund of indirect tax assessed on the materials, mitigation of IUM (mine production tax) tax, reduction of interest rate of governmental financing and expansion of the finance limit.

by taking measures such as refund of indirect tax assessed on the materials, mitigation of IUM (mine production tax) tax, reduction of interest rate of governmental financing and expansion of the finance limit.

Since the new deposit has the largest ore reserve in the area, its development will put new

life into the mining industry of the area where mineral production is currently being reduced, and greatly contribute to employment.

4) Redevelopment of Existing Five Mines

With regard to the existing five Furnas, Penelas, Barrinha, Rocha and Perau, mines it is not practical to establish an overall development plan because they are operated by different companies and because there is a great difference in the ore reserves, as well as in mining and dressing technologies, between the mines.

It is necessary for the companies to stabilize the mining operation by promoting exploration to establish the ore reserves and by introduction of effective technology.

The following proposals are recommended to the mines.

a) Perau Mine

Prospecting: Development of the G-4 level and underground drilling are recommended for exploration of the northern extension of the Perau deposit operating at present.

Mining : The pillars should be recovered by the waste filling method because the wall rock is strong enough. For developing the lower part, below the G-2 level, it is preferable to sink an inclined shaft along the ore body and to adopt a skip winding haulage method.

Dressing : The feeding of ore to the new dressing plant to be built at the time of development of the new deposit should be investigated.

b) Furnas Mine

Prospecting: The fissure pattern of veins should be investigated to make clear the ore shoot and to apply it to the exploration of the downward extension of the deposit. A geochemical prospect and geophysical survey along the ore bearing horizon is desirable.

Mining: The mining method using waste filling, used at present, appears to be appropriate. It is recommended to enlarge the diameter of the air pipe to raise the efficiency of the compressed air. It is also recommended to use pick hammers in narrow working faces.

Dressing: Experiment and research on dressing of lead and zinc oxide ores is needed.

c) Panelas Mine

Prospecting: Since exploration within the mine has almost been completed, it is necessary to carry out exploration for new areas including contact, metasomatic type deposits. A detailed survey of the showings of strata-bound deposits of lead, zinc and barite in the Canoas areas is desirable.

Mining: The mining system is well organized when compared with other mines.

Dressing and Refining: There are no particular comments on the equipment and techniques of these operations but pollution control by proper treatment of the tailing dressings and the stack gas refining is necessary.

d) Barrinha Mine

Prospecting: It is necessary to confirm the down-chute of the deposit by continuing exploration. A drill survey for the geophysical anomaly (SIP) detected to the southwest of the deposit is recommended.

Mining: While mining is operated by sublevel stoping, the working environment is dangerous because of the irregular setting of the working face. The diameter of the pipe from the compressor should be enlarged.

Dressing: New installation of mechanical dressing facilities will not be required if the mine continues high-grade ore production.

e) Rocha Mine

Prospecting: It is recommended that the underground mapping be continued to follow the distribution of dolomite and that effective exploration be continued for the lower extension of the deposit.

Mining: It is recommended that introduction of the shrinkage method, in addition to present sublevel stoping, is investigated.

It is necessary to consider safety measures for the workers by preparing a manway in the raise. Electric detonators for blasting in the raise should be used.

Dressing: It will be necessary to consider a pollution control system for treatment of tailings.

5) Summary of the Ribeira Area Development

The development of the Ribeira area has been discussed, centering on the development of the new deposit, taking the organization of infrastructure and redevelopment of the existing five mines into consideration. The start of the project will have various effects on the area.

Technically, adoption of systematic exploration and mining methods as well as the development of the technology for separating minerals by differential flotation will give impetus to the technique of mine development of the area and lead to the transfer of various new technologies.

Economically, an exchange, including promotion of employment and purchase of materials, will be activated, leading to increased welfare resulting from increase of tax revenues to municipal bodies.

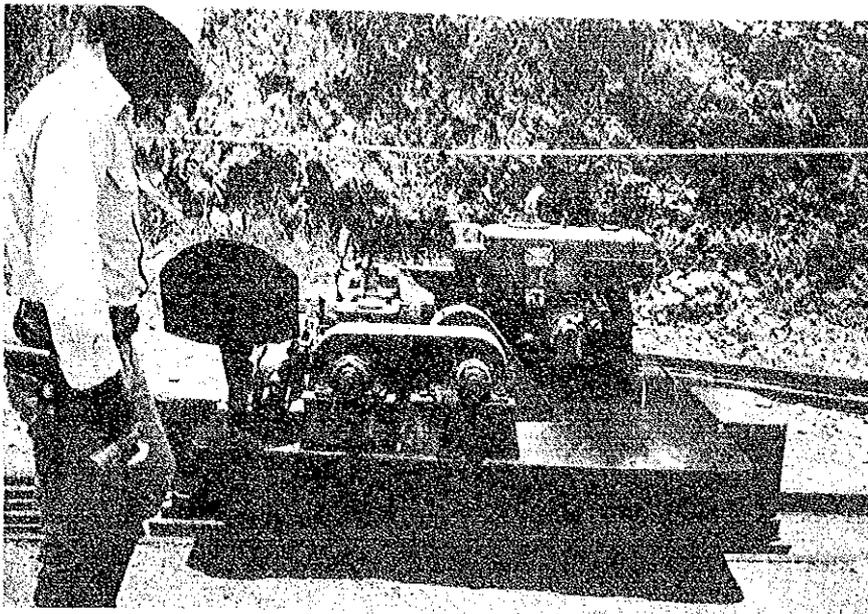
Although development of the deposit on a private basis seems to be difficult in the present market climate a time will come when the development will be possible considering factors such as supporting measures to be taken by the Government, rise of metal prices and increased ore reserve estimates.

It is sincerely hoped that a detailed survey of the new deposit will be promoted so as to grasp future opportunities.

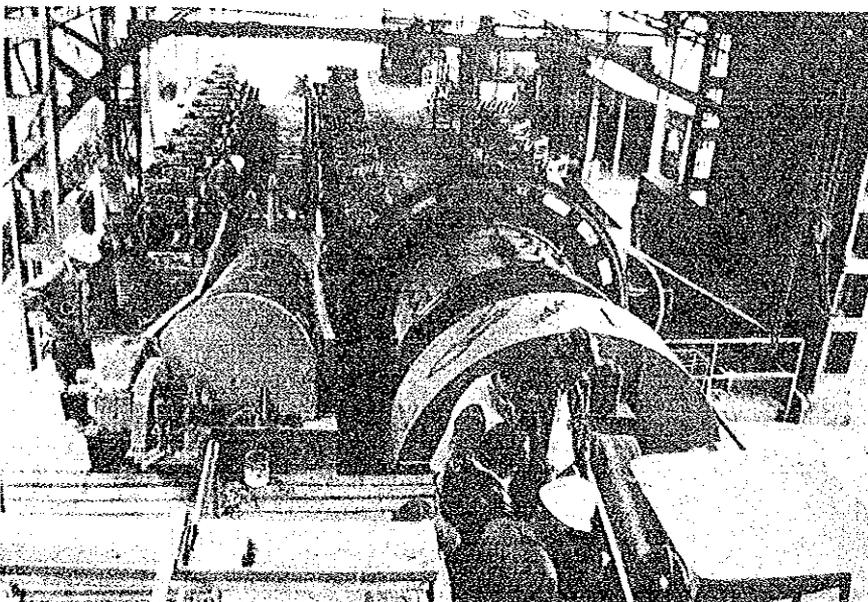
Appendix

- 1) Photograph of Investigation in Brazil
- 2) References
- 3) Production of Lead Ore in Ribeira Area

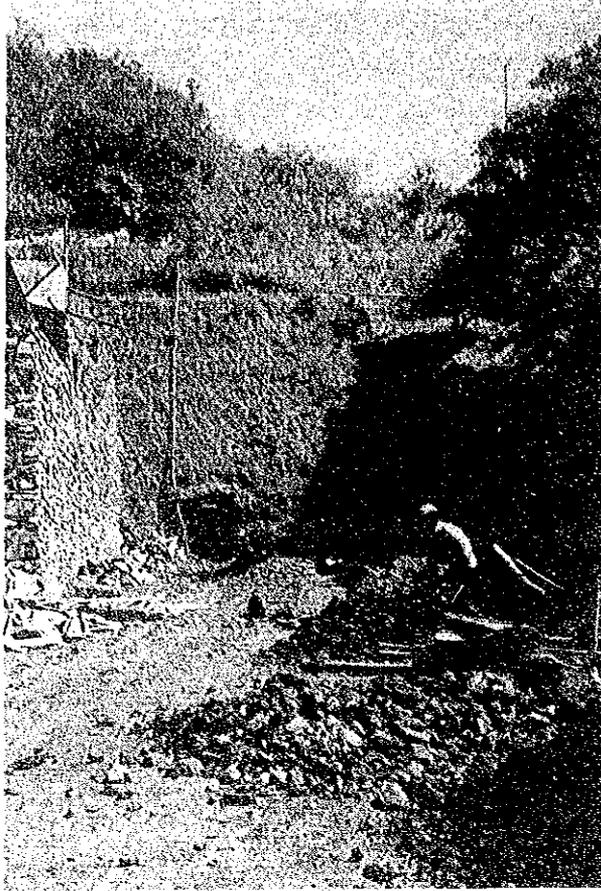
1) Photograph of Investigation in Brazil



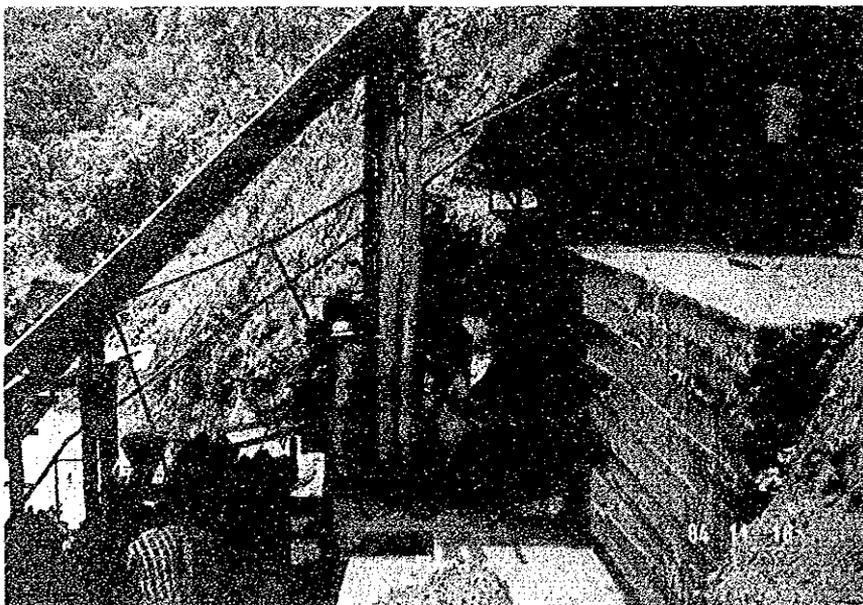
Panelas mine
Locomotive (Home made)



Panelas mine
Dressing plant



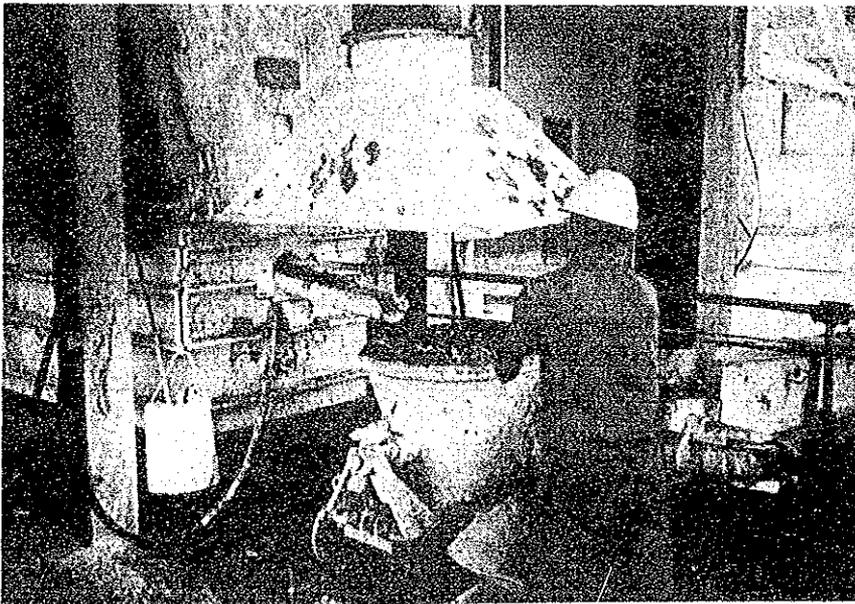
Frunas mine
Adit Mouth



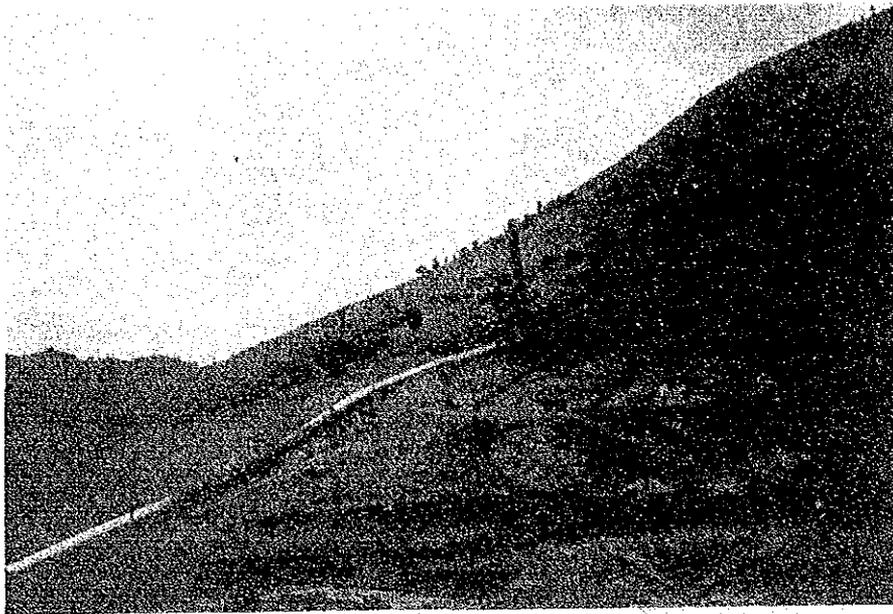
Barrinha mine
Test plant of ore dressing



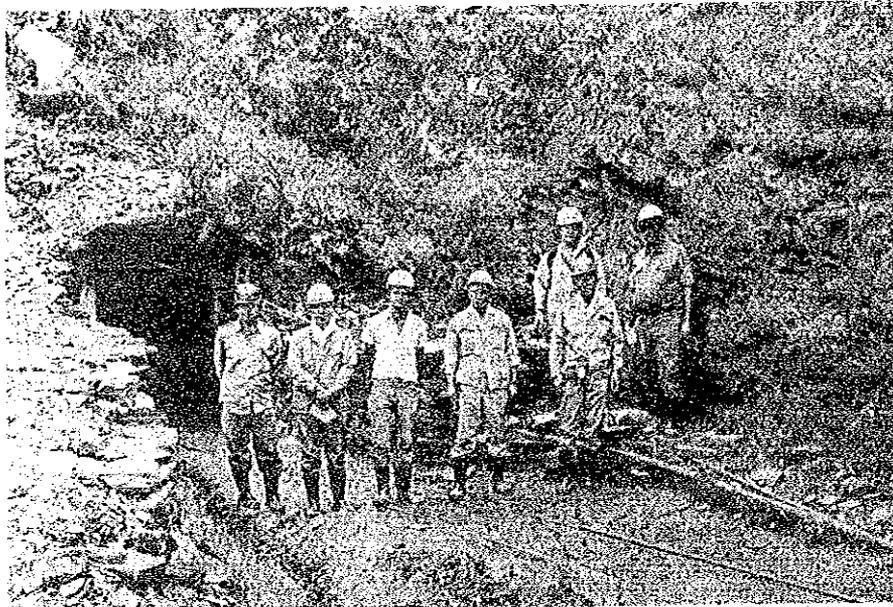
Panelas mine
Calcination



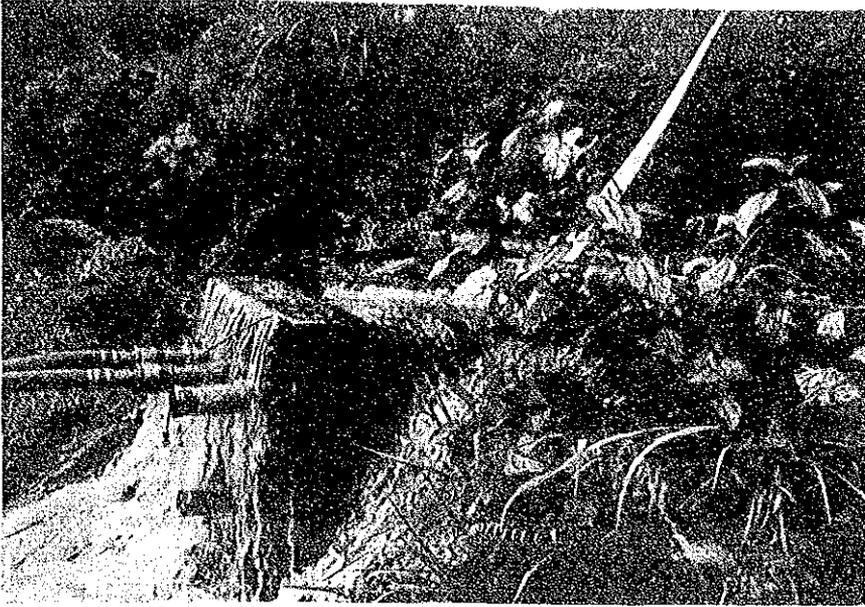
Panelas mine
Refining of Lead



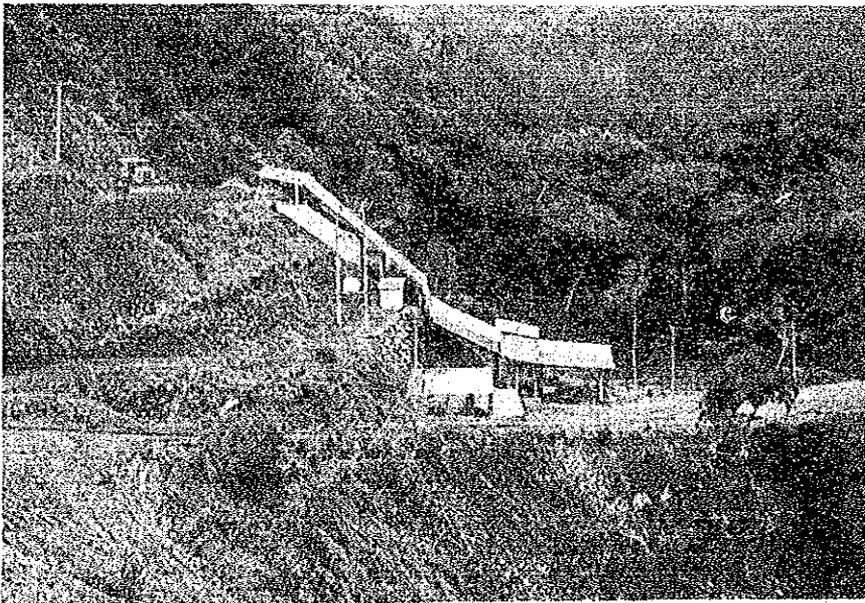
Panelas mine
Chimney
of Stackgas



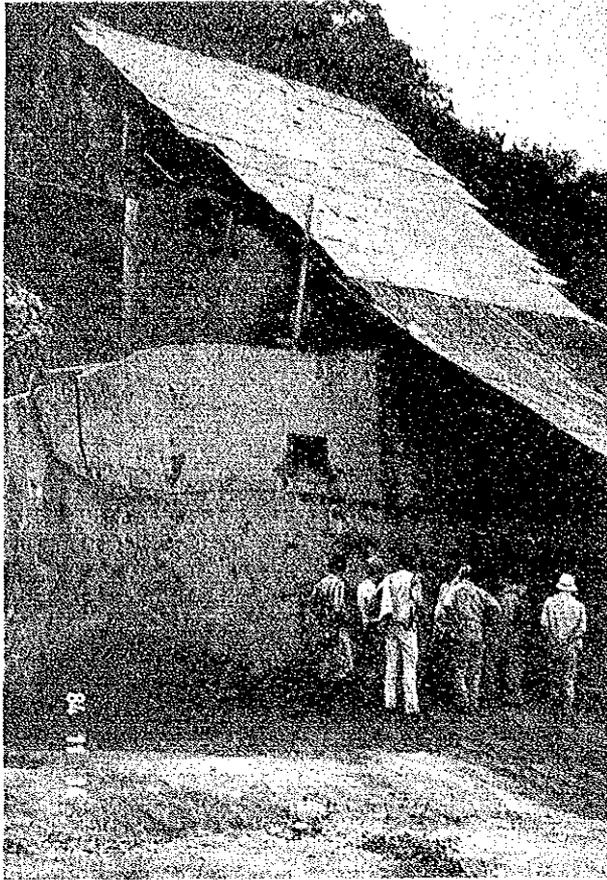
Perau mine
Adit mouth



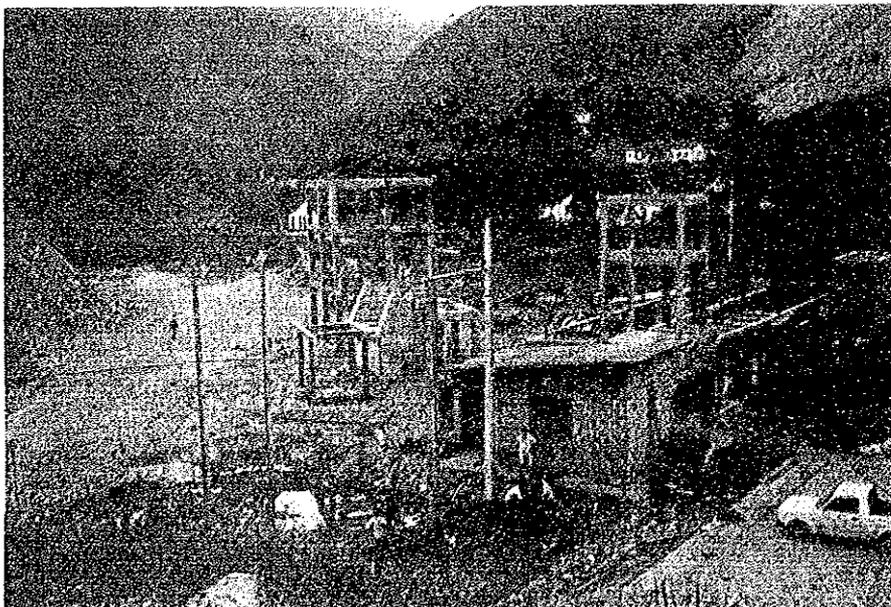
Perau mine
Water Supply
from river water



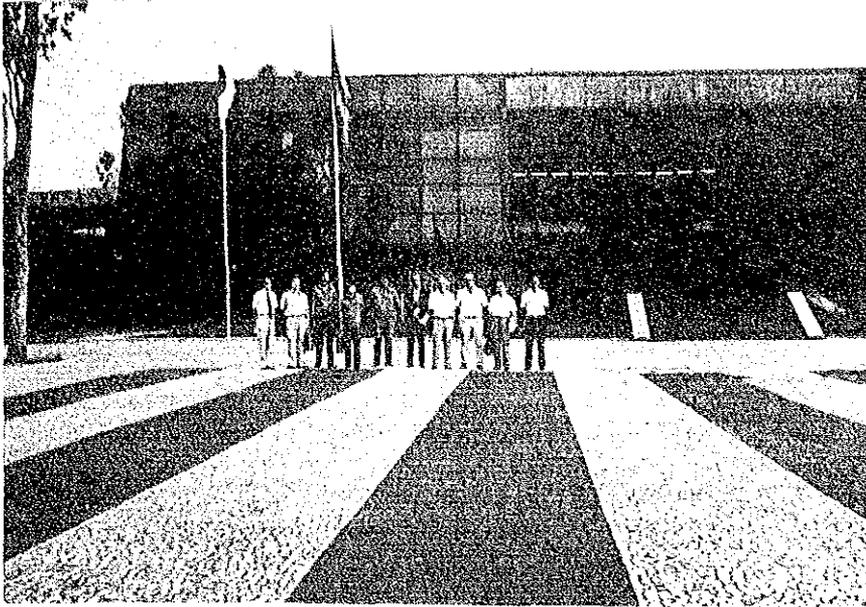
Perau mine
Test plant
of Dressing



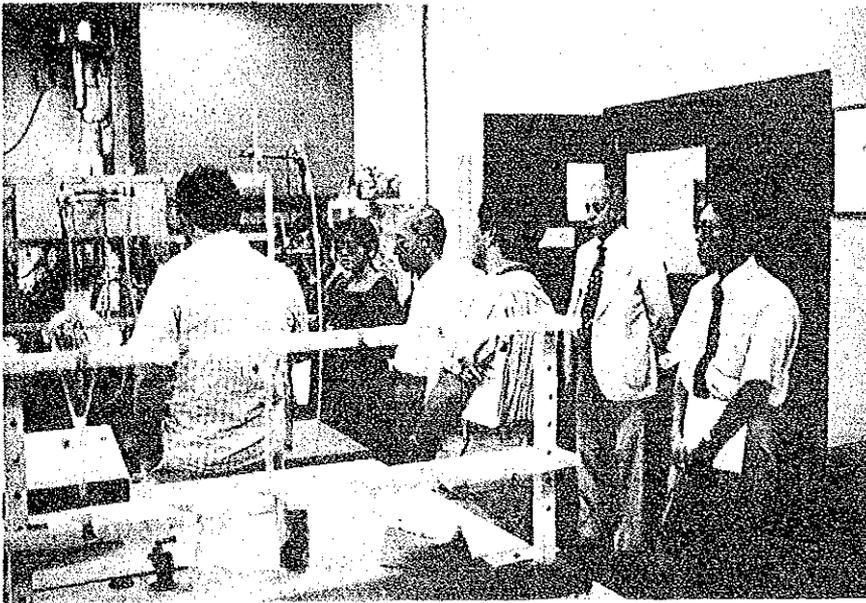
Rocha mine
Dressing plant



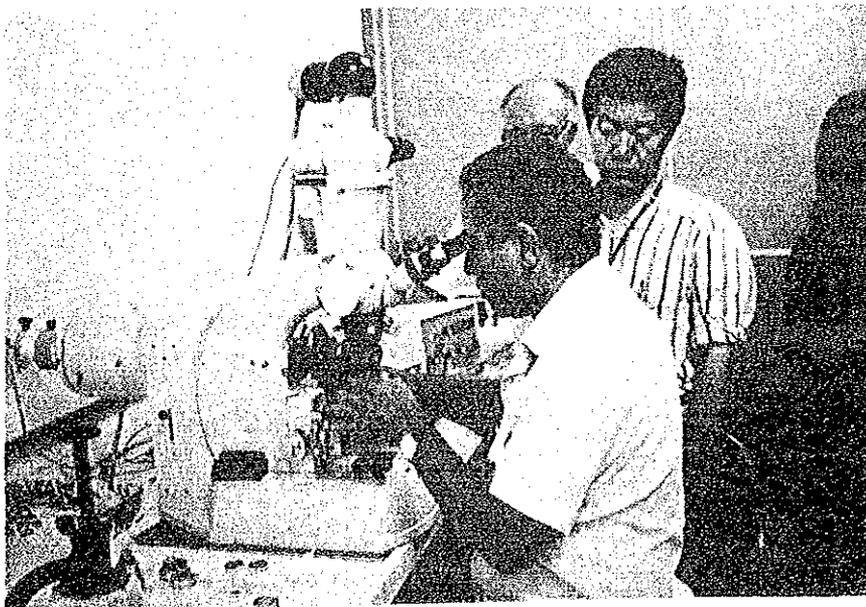
Rocha mine
New Dressing plant
(under construction)



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3) Production of Lead Ore in Ribeira Area (1)

ANOS	PANELAS ¹⁾		ROCHA		LAGEADO		FURNAS		PAQUEIRO		DIOGO LOPES		BUENO		
	MINERIO ²⁾	Pb%	CONDITO ³⁾	MINERIO	Pb%	CONDITO	MINERIO	Pb%	CONDITO	MINERIO	Pb%	CONDITO	MINERIO	Pb%	CONDITO
1943															
1944	4.000	40,0	1.600												
1945															
1946															
1947	4.380	20,8	910												
1948	8.122	20,8	1.692												
1949	10.000	24,0	2.400												
1950	14.762	23,7	3.506												
1951	14.086	22,8	3.206												
1952	12.921	23,0	2.973												
1953	13.260	23,9	3.169												
1954	35.840	8,05	2.886												
1955	49.730	7,04	3.500												
1956	33.865	6,38	3.436												
1957	59.112	5,74	3.392												
1958	50.183	5,74	2.881												
1959	53.730	5,98	3.213												
1960	53.429	5,36	2.866												
1961	49.900	6,84	3.412	17.419	8,52	1.485									
1962	48.857	6,31	3.083	24.054	6,99	1.751									
1963	42.742	6,78	2.897	26.674	5,39	1.438	974	12,9	126						
1964	41.735	5,71	2.382	29.370	5,71	1.676	1.705	6,45	110						
1965	33.289	5,06	1.684	45.823	6,02	2.758	1.267	8,44	107						
1966	37.323	5,93	2.215	47.914	5,82	2.791	1.615	10,1	164	182					
1967	45.618	5,16	2.356	44.571	5,44	2.425	1.450	10,4	151						
1968	53.744	4,56	2.449	36.808	5,45	2.007	472	15,9	75						
1969	53.411	4,62	2.467	38.383	5,54	2.125									
1970	56.443	4,55	2.569	38.196	5,26	2.011									
1971	54.283	4,89	2.656	39.147	5,24	2.052									
1972	52.797	5,04	2.659	42.883	5,18	2.222									
1973	43.588	5,78	2.521	37.424	5,74	2.147									
1974	38.641	6,19	2.393	22.481	5,65	1.270									
1975	31.190	6,82	2.127	11.308	5,25	594									
1976	33.315	6,24	2.078	9.468	5,51	522									
1977	32.947	5,95	1.959	11.877	5,88	698									
1978	26.059	6,24	1.627	13.606	6,42	874									
1979	29.294	5,79	1.697	16.552	7,10	1.175*									
1980	24.716	5,63	1.393	23.685	7,51	1.778*									
1981	23.203	5,28	1.234	27.460	7,48	2.053*									
1982	15.137	5,13	776	17.903	10,86	1.944*									
1983	12.245	5,40	662	14.464	11,12	1.608*									
TOTAL	1.317.897*	6,90*	90.916	637.470	6,18	39.406	7.483	9,80	733	1.268	1.44	9.72	14	56	10,6

Note: 1) Mine name.

2) MINERIO : Amount of Production (t/Year)

3) CONDITO: Pb Content

3) Production of Lead Ore in Ribeira Area (2)

ANOS	LARANJAL		PESCARIA		BARRINHA		PERAU		ABERTA DO LEAO		TOTAL GERAL					
	MINERIO	Pb% CONDITO	MINERIO	Pb% CONDITO	MINERIO	Pb% CONDITO	MINERIO	Pb% CONDITO	MINERIO	Pb% CONDITO	MINERIO	Pb% CONDITO				
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1968																
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1971																
1972																
1973																
1974																
1975																
1976																
1977	68	3,0														
1978	34	9,0														
1979																
1980																
1981																
1982																
1983																
TOTAL	107	5,60	6	1,313	4,73	65	41,903	19,53	8,185	152,850	6,85	10,464	167	18,6	31	10,464

JICA