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DP/UN/JAM-90-002/1
JAMAICA

UNITED NATIONS

DEPARTMENT OF TECHNICAL COOPERATION
FOR DEVELOPMENT

MINERAL RESOURCES DEVELOPMENT

Project findings and recommendations

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Project findings and recommendations

Prepared for the Government of Jamaica
by the United Nations
Department of Technical Cooperation for Development
acting as executing agency for the
United Nations Development Programme

New York, 1992

NOTES

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The monetary unit in Jamaica is the Jamaican dollar (J$). During the period covered by the report, the value of the Jamaican dollar in relation to the United States dollar ranged from $US 1 = J$ 7, in January 1990, to J$ 22 in February 1992.

As of March 1992 the functions and programmes of the United Nations Department of Technical Cooperation for Development (UNDTCD) are carried out by the newly formed United Nations Department of Economic and Social Development (UNDESD).

Abbreviations used:

DTCD	- Department of Technical Cooperation for Development
EDP	- electronic data processing
GSD	- Geological Survey Division
JAMPRO	- Jamaica National Investment Promotion Company
MME	- Ministry of Mining and Energy
UNDP	- United Nations Development Programme

ABSTRACT

From February 1990 through February 1992, the United Nations in cooperation with the Government of Jamaica, and supported by a contribution of $US 630,180 by the United Nations Development Programme, carried out a project to further the development of quarries and mines in Jamaica, Equipment and training was provided for a mobile quarrying unit. Seven quarry faces were opened, marble samples taken for evaluation, and owners and interested investors advised on the marketing potential for such dimension stone. Expert consultants advised and prepared reports on quarry planning and engineering , marble marketing, environmental concerns, marine loading and shipping facilities, and mining and mineral legislation. The potentials for mining guano as fertilizer, and vesicular volcanic rock for horticulture were briefly investigated. Continued assistance in developing a marble industry and other mineral deposits, and attracting outside investors, is recommended.

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INTRODUCTION

As a consequence of successful earlier non-metallics minerals projects, and subsequent requests by the Government of Jamaica for continuing development of this sector, the United Nations Development Programme (UNDP) and its executing agency, the Department of Technical Cooperation for Development (DTCD), together with and under the auspices of the Ministry of Mining and Energy (MME) through the Geological Survey Division (GSD), undertook the project Mineral Resources Development (JAM-90-002).

The project covered the period 15 February 1990 to 29 February 1992, (25.5 months) and concentrated mostly, but not exclusively, on marble development. As time and resources permitted, it was planned additionally to investigate other resources, notably guano, high-purity limestone, igneous rocks, clay and semi-precious stones. Five short-term consultancies were provided in support of mineral resources development and to identify the constraints and impediments facing the non-metallics minerals industry in Jamaica. Subject investigations covered:

1. Marble quarry planning and engineering;
2. Local and international marble marketing;
3. Environmental concerns with mining and quarrying;
4. Marine bulk loading and shipping constraints; and
5. Mining and mineral legislation recommendations.

The project was a logical follow up, especially in terms of marble development, of earlier programmes which had favourable exploration results. A significant aspect of the project was investor participation, including cost-sharing for the project's mobile mining team. This team included carefully selected heavy equipment designed for extracting blocks of dimension stone measuring up to three cubic metres in size for evaluation in the GSD marble shop.

The project was implemented by a team of international experts and GSD staff (annex III). Staff were trained to operate the various units of equipment. The major objective of the mobile mining team was to provide interested investors with state-of-the-art technical assistance in evaluating their marble properties which should lead to viable marble businesses. Originally, ten marble prospects with their respective investors were to be assisted. This number was

later cut to seven, due to unexpected funding constraints and delays in receiving equipment.

Four to eight weeks were spent at each field location and involved the preparation of a quarry face from which commercial-sized marble blocks were extracted for physical testing and market evaluation, primarily at GSD. The project achieved most of its marble objectives, i.e., seven opened marble quarries with serious investor intentions to develop export-oriented marble businesses. Other mineral resources were investigated as time permitted. These included high-purity limestone, vesicular lava rock and guano.

A shortage of qualified staff is a serious and growing problem in the Geological Survey Division. There is an increasing inability to attract qualified geologists because of low salary scales. This has also resulted in the resignations of senior trained staff members to the detriment of GSD and UNDP-assisted projects. At the end of the project, GSD was well poised from an equipment standpoint to continue providing investor assistance but it still lacked adequate staff.

Much equipment was provided by UNDP (see annex IV). It is urged that the Government of Jamaica, through its Ministry of Mining, provide sufficient funding to maintain the equipment and buy spare parts. Its continued use in research and development for the non-metallics mineral sector should contribute much to further Jamaica's development.

A major concern during the project was the environment. As is well known, surface mining, if done improperly, can be environmentally degrading. The project demonstrated how surface mining, especially dimension stone quarrying, could be properly carried out, especially since most mineral deposits in Jamaica are located in environmentally sensitive areas. Guidelines for the future were also recommended by a consulting mining environmentalist.

The final project costs were $US 916,510, distributed as shown in table 1.

Table 1. Project funding, UNDP and Government of Jamaica

Source	Original funding (1990)	Additional funding (1991-92)	Total
Government	J$ 711,074	J$ 2,678,846	J$ 3,389,920
Converted to US$	US$ 101,582	US$ 184,748	US$ 286,330
Rate of Exchange	J$ 7.10 = US$ 1.00	J$ 14.50 = US$ 1.00	-
UNDP	US$ 443,180	US$ 187,000	US$ 630,180
Total	US$ 544,762	US$ 371,748	US$ 916,510

I. PROJECT CONCERNS AND OBJECTIVES

A. Status of Jamaican minerals industry

A number of factors were restricting Jamaica's ability to maximize benefits from its natural resources. Although extensive interest had been voiced from potential foreign and domestic investors, there was still investor reluctance because it was difficult to assess the technical and commercial marketability of the marble. The national laws and regulations which governed the industrial minerals mining industry were not only archaic, but also permitted speculators to obtain cheap leases for deposits with great potential for development with no consequences for reneging or investment commitments given at the time of negotiation of the lease which provided a disincentive to other investors. Even more serious disincentives were the limited and restrictive port facilities for shipping bulk minerals.

Environmental concerns must be held paramount while developing the industrial minerals sector. However, clear guidelines and regulations to govern environmentally sustainable operations did not exist. Finally, while all estimates and indications clearly indicated great potential for penetration, knowledge about specific market conditions was inadequate for investment decisions. Reliable quality control expertise with respect to international marble standards, essential if export markets were to be sought, had not yet been developed. More specific points to be addressed by the project were the following.

The main problem concerned the difficulties of assessing the technical viability and evaluating the commercial marketability of marble at various investor locations island-wide and the consequent importance of opening up quarry faces for a clear understanding by all concerned. This was intended, and proved, to be a much faster technique than utilizing only core drilling, even though core drilling must still be done by marble operators to ensure future reserves and good quality. In addition, core drill samples cannot provide as many physical criteria as can be gained from a commercial-sized marble block at least a cubic metre in size.

In order to accomplish the above, a mobile mining system was needed to open the numerous quarry faces after which it would be possible to advise on quarry planning and to

demonstrate marble extraction techniques at the seven different locations.

Significant field operating expenses were partially offset by requiring the respective investors to share field costs as a condition for technical assistance. This also served to identify the more serious and dedicated investors.

The project made major efforts in teaching and demonstrating environmental protection and state-of-the-art methodology in surface mining and quarrying for marble and other minerals.

A constructive review of national mining and mineral legislation was made to better accommodate present-day 1) national mineral interests, 2) environmental concerns, 3) investment attractions and concerns, and 4) elimination of mining license abuses and excesses.

Technical advice on minerals and mining matters as well as marketing assistance and direction was provided by expert consultants. It covered such areas as quarry planning, environmental considerations, quarry equipment, marble shop equipment, marketing strategies and financing possibilities.

A serious problem for minerals development was a lack of adequate bulk mineral shipping facilities which impeded the export of aggregate and limestone from Jamaica. This constraint was evaluated by a consultant who listed the various options available to its resolution.

The project prepared evaluation reports (listed in annex II), including maps, for each respective property, to help the investors interest joint-venture partners and, in some cases, secure loans from development banks and other sources.

While the project was primarily concerned with development of marble resources, other industrial minerals previously recognized for their economic potential were singled out for special project evaluation, i.e., guano, lightweight aggregate, high-grade limestone and volcanic rock. Previously mentioned time constraints, however, limited such efforts despite promising preliminary results.

B. Objectives and intended output

The national development objective of the project was to establish minerals based industries, thus creating employment opportunities in rural areas of Jamaica, providing building

materials for the local construction industry and creating foreign exchange earnings through import savings and increased export sales. Two immediate project objectives were intended. The first was that the Government of Jamaica and related agencies be enabled to conclude marble mining investment negotiations with local and overseas investors through the provision of detailed technical data on volume and quality of available resources, and confirmation of incentives. This would entail the provision of a fully equipped mining unit, the opening of ten marble faces (later reduced to seven), and technical reports for each evaluated and assisted location.

The second immediate objective was that prospective local and overseas investors be enabled to make joint venture investment decisions through the identification and removal of policy and logistic constraints. This would entail six studies and reports by consultants on 1) marketing options for Jamaican marble, 2) the technical conditions and constraints associated with marble quarrying, 3) the impact of industrial minerals extraction on the environment and recommendations for national guidelines on environmental protection, 4) review of national laws and regulations pertinent to mining and recommendations for revising legislation, 5) procedures to be followed to accelerate investment and interest, and 6) various cost-effective options for expanding and improving marine transportation for export shipments of bulk industrial minerals from Jamaica.

The consultancy study on stimulating investment (5 above) was cancelled in May 1991 by the Government as being redundant and unnecessary because it was already under evaluation by others. A list of the consultant reports prepared is given in annex II.

C. Mid-project revisions

Funding shortfalls by the Government between November 1990 and April 1991 created problems in the maintenance and operation of field and shop equipment. The problem was partially alleviated by budgetary adjustments and an additional contribution by UNDP but, nevertheless, delays were incurred that slowed field work. Because of this, and delays in receiving major units of equipment, the original objective of opening ten marble quarry faces was reduced to seven.

The original project plans called for the use of older field vehicles from earlier projects. After six months,

however, increasingly severe maintenance problems led to a decision to sell three of the old vehicles and apply the proceeds towards the purchase of two new field vans. Use of a second-hand oil field truck for moving marble blocks and heavy equipment, instead of an expensive new crane, proved ideal for the mobile mining unit. It was further improved by local modifications that included shortening the truck by two metres for use on rural Jamaican roads.

Midway through the project an adjustment was made in the area of consultancy requirements. The Government determined that an investment expert would not be necessary as efforts in this area were already being conducted by the Jamaican National Investment Promotion Company (JAMPRO). In addition, strong signals from the Italian Government during 1990 suggested that significant assistance in the marble sector would be forthcoming, especially investment. Subsequently, joint ventures were undertaken between investors and Italian partners.

The legal consultancy was undertaken by a United Nations Interregional Adviser for Mining Legislation and Promotion at no cost to the Government.

II. RESULTS

A. Output

1. Field and shop work

A mobile mining unit was created and functioned ideally for the purpose intended. For six months between March and September 1991, nine national staff were trained in operating the air track drill and compressor, the flat-bed truck and the marble shop, and in their application to differing mining situations and conditions. It included environmental impact studies at each site and the necessary steps to minimize degradation from quarrying activities. Key equipment acquired for the mobile mining unit included an air track drill (crawler type), an air compressor for the drill (800 cubic feet per minute), a heavy-duty flat-bed truck with twin 30-ton winches, a quarry bar (line drill), and a van type pick-up truck.

Seven marble deposits were initially opened for potential investors who, to varying degrees, subsequently moved towards development depending on their respective financial resources and business plans. An additional four marble areas with lesser degrees of investor interest were partially evaluated towards an eventual goal of full-scale development. The steps taken by the Geological Survey Division in evaluating the potential marble quarries are outlined in table 2. The specific steps varied from site to site but all steps were anticipated and implemented as needed.

It should be noted that most marble deposits evaluated under this project were discovered during earlier UNDP/GSD projects. Furthermore, this and earlier projects have proven that the marble resources of Jamaica are vast and represent mineral assets of major economic importance worthy of larger investment attraction.

Technical evaluation reports were prepared for the respective sites with copies for the investors to assist their further objectives which likely will include financing, development and, in some cases, joint ventures. The reports produced are listed in annex II.

DP/UN/JAM-90-002/1: Points to be included in letter of transmittal

The project, carried out from February 1990 to February 1992, was the logical follow-up of earlier exploration programmes. The concept of forming a mobile quarrying unit furthered the development of mineral resources, specially marbles, by opening seven marble quarries, providing marble samples for evaluation and investment promotion, and practical training for the Jamaican personnel of the Geological Survey Division (GSD).

Consultants advised and prepared reports on quarry planning and engineering, marble marketing, environmental concerns, marine loading and shipping facilities, and mining and mineral legislation.

A primary objective was assistance and advice to local quarry owners and interested investors. A significant aspect of the project was investor participation, including cost-sharing for the project's mobile mining team. Investment promotion attracted is evidenced by the number of marble ventures now in progress.

The potential for other resources such as guano for fertilizer, vesicular volcanic rock for horticulture, and aggregates for road building was briefly investigated.

The project recommended that a marble technical centre or institute be set up -- an idea supported and requested by local industrialists -- which should incorporate the mobile mining team already formed. The purpose of the institute would be to oversee the orderly development of this resource, import marble resources from other Caribbean nations to finish them for export purposes, and serve as a training centre for personnel and investors of this Region. Finally, the GSD should follow up on other industrial minerals worthy of economic development.

Reports Unit, PSD/DTCD

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Table 2. Geological Survey Division work flow in evaluating potential marble quarries

Phase	Activity	Other parties involved	Means and options
1. Site selection	Identify marble deposit	Owner, investor	Review of previous surveys, records, quarrying history
2. Geologic evaluation	Reconnaissance Survey	-	Owner decides between independent action and cost-sharing contract with GSD
3. Contract agreement	Negotiate terms	Owner, investor	Provide for security, site clearance, core drilling, topographic mapping, mining and reclamation plans, sampling, blasting, clean-up, haulage
4. Prospection rights and license	Make and file applications	Mines and Quarries Division	-
5. Topographic mapping	Surveying and drafting at 1:1,200	-	By contract
6. Mine planning	Anticipate quarry operations	Mines and Quarries Division	-
7. Environmental and reclamation planning	Prepare environmental impact study	Mines and Quarries Division	-
8. Core drilling	Obtain rock samples	Local drilling companies	By contract
9. Drill quarry face	Face up marble deposit	-	Air track drill

Phase	Activity	Other parties involved	Means and options
10. Blasting	Shape quarry face	Mines and Quarries Division	By contract
11. Clean up quarry	Grade, dispose of waste rock	Owner	By owner or contract
12. Quarry drilling	Drill blocks for extraction	-	Air track drill
13. Shape blocks	Split or blast	Mines and Quarries Division	By GSD crew or contract
14. Move blocks to GSD	Lift, load and transport	-	Flat-bed truck
15. Evaluation	Cut, slab and polish	-	At GSD marble shop
16. Subsequent marketing	Sell property, enter into joint venture or operate alone	Owner, JAMPRO	Owner or investor must decide on how to act on GSD evaluations

2. Consultants

Five consultants made studies and prepared reports (listed in annex II).

Dr. Robert Pisani (Italy), a world marble consultant from Carrara, Italy, visited the project and prepared a report covering marketing options for Jamaican marble.

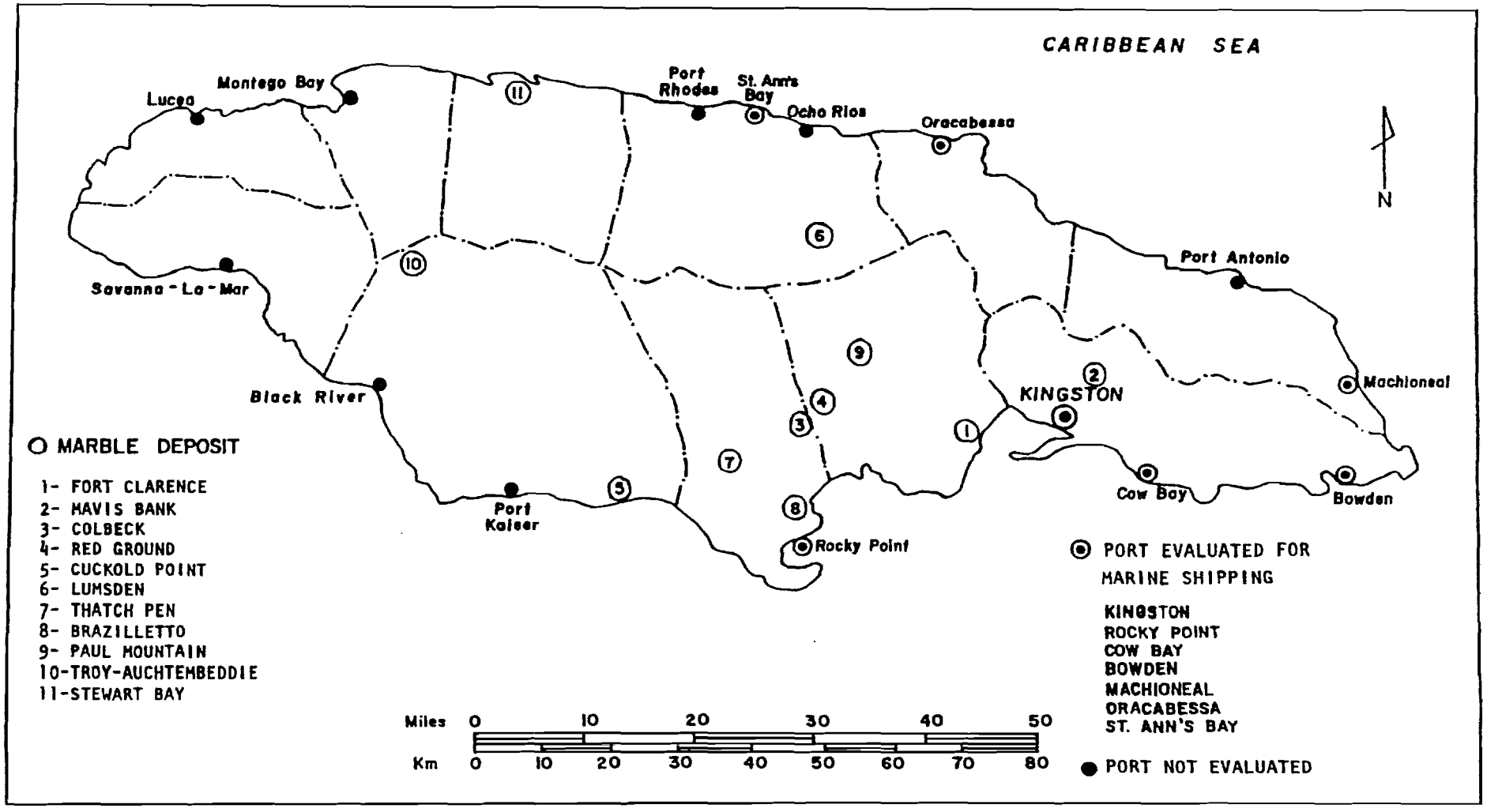
Mr. Lance Meade, a marble mining expert formerly with the Vermont Marble Company (USA), reviewed various marble quarry sites and provided guidance and advice on special quarrying techniques for the typical range of Jamaican mining and quarrying conditions. His report is on technical conditions and constraints associated with marble quarrying.

Mr. John Miedecke (Australia), mining environmental expert, visited Jamaica and addressed the various concerns and constraints associated with quarrying and mining in a fragile mining environment such as exists in Jamaica. His report is on the impact of industrial mineral extraction on the environment; it makes recommendations for national guidelines on environmental protection.

Ms. Diana Dalton (Canada) United Nations Interregional Adviser in petroleum and mineral legislation, came to Jamaica (under the United Nations Regular Programme) and reviewed existing mining and mineral laws for the purpose of recommending amendments and changes beneficial to minerals development including environmental concerns, public rights, and the Government's minerals policy goals. Her report is on review of national laws and regulations pertinent to mining; it makes recommendations for revising existing legislation.

Mr. John Lescroart (United States), retired president of a major marine shipping company, visited Jamaica and reviewed port facilities in the eastern half of the island for the purpose of recommending solutions to constraints on the shipment of large-tonnage, low-unit-value mineral commodities such as limestone to coastal ports in south-eastern United States (see figure). His report covers various cost-effective options for expanding and improving marine transportation for export shipments of bulk industrial minerals from Jamaican ports.

There were investigations into several other industrial mineral resources. These included deposits of guano, a valuable fertilizer derived from the excreta of bats, found in moderate to large amounts in the many caves in Jamaica's extensive karstic limestone terrane. Guano is especially



Location of marble deposits and ports evaluated for bulk shipping, Jamaica

desirable as a fertilizer and has good markets not only locally, but also overseas where its strictly organic nature makes it desirable for specialty horticulture and vegetable growers. It is a high-unit-value commodity, often sold by the kilogram rather than the ton. Because of this, a 5,000- or 10,000-ton deposit has potentially high value and deposits this large appear, from the preliminary data, to be common in Jamaica. The project staff could make only limited assessments of a few caves but the evidence suggests this to be a substantial resource worth exploiting for export and could provide employment for scores of workers in rural Jamaica. Other side benefits could include the discovery and development of several caves as tourist attractions.

Another potential resource investigated by the project staff is vesicular volcanic rock which occurs in the upper portions or near-surface zones of volcanic eruptive rocks. Its vesicular nature is a consequence of trapped gas bubbles that created tiny voids during the hardening stage after eruption. Its occurrence in Jamaica is limited to only a few locations with the most significant being the Low Layton lava flows along the north-eastern coast in West Portland Parish. Preliminary experiments by agriculturists suggest that, when crushed and sized, it is an ideal growing medium for orchids and other high-value plants. The project assisted in assessing reserves and providing several tons of the material for further experiments and test.

3. Training and study tours

For six months between March and September 1991, nine members of the staff of the Geological Survey Division were given on-the-job training in operating and maintaining the equipment provided by UNDP. These included the air track drill and compressor, the flat-bed truck, and the marble finishing shop. The National Project Director, Mr. L. Henry, attended the Twenty-sixth Forum on the Geology of Industrial Minerals (13-18 May 1990) and "Stone Expo 91", the North American Stone Industry Exposition (13-16 March 1991).

B. Assessment and conclusions

The project achieved most of its objectives, despite delays in receiving equipment, restricted funding and shortage of qualified personnel. Design of the project was therefore basically sound.

Project assistance to potential investors succeeded in promoting significant interest as evidenced by the number of

marble ventures now (1992) in progress. Testimonials to this effect were received from investors who indicated gratitude for the project, regrets that it ended and requests for continuing help. Those assisted are listed in annex I and the quarry locations are shown in the figure.

The "mobile mining team" concept proved an effective method of providing rapid practical, hands-on assistance in opening up a quarry. The equipment provided by UNDP proved effective. The mobile mining team concept, however, does not diminish or negate the importance of core drilling. Investors and quarry owners must still provide for it as their respective quarries are expanded.

The requirement of cost-sharing placed on potential investors when evaluating their respective marble deposits proved to be a wise step. Besides the obvious advantage of reducing project field expenses, it resulted in a high level of interest from investors and identified more serious investors as distinct from others less interested and dedicated.

The cost of maintaining the equipment provided will be a major future expense that should be given high priority by the Government if marble development is to continue. Since use of all the equipment is interrelated, the downtime or failure of any one unit can cause much or all of the system to slow or halt.

The role of the Geological Survey Division should be clearly redefined in view of national priorities if it is to play a strong role in the country's minerals development programme. Assuming it will, then it should be supported and strengthened by the Government especially in terms of recruiting, motivating and retaining qualified professional staff. Thought should be given to making the Geological Survey Division a statutory organization as exemplified by the Jamaica Bauxite Institute. This would allow GSD to offset, in part, its operating costs with income from services. The statutory organizations that now exist are better organized and able to hold onto good professional staff.

The project could have accomplished considerably more towards evaluation of additional marble deposits and industrial mineral resources had not numerous constraints retarded progress. Careful attention should be given to those restraints and avoided in the execution of any future projects.

Delays were experienced in receiving critical equipment and spare parts, because of mostly cumbersome import and customs procedures. These hampered the project and clearly showed that such impediments discourage potential investors, especially when there is growing competition from "easier investment climates" in other countries.

The value of the air track drill and compressor for many minerals other than marble was demonstrated. This equipment provides GSD with important means for evaluating many other Jamaican mineral resources, including metallics.

C. Recommendations

The development of non-metallic, industrial mineral resources in Jamaica should be continued. The potential for its future significant economic contribution to the country is excellent. The possibilities are good for discovery and development of other economically valuable industrial mineral resources that have been recognized but not yet fully evaluated. The mineral resources currently under development and investment, especially marble and limestone, have a considerably greater potential for investment expansion because of increasing foreign and domestic market interest and the presence of extensive reserves.

Annual production from government sources show that locally produced industrial minerals have not yet made much of an impact or contribution to the Jamaican economy. It should be recognized, however, that the lag time between mineral exploration and significant contribution to any economy is usually lengthy but even more so in developing countries. Fortunately the lag time in Jamaica has been reduced in the case of industrial minerals development because of this and earlier related projects. Nevertheless, more industrial mineral development can and should be pursued and in this regard the following recommendations are made:

1. In order to support the continuance of an investor programme for marble and other minerals it is strongly recommended that the Government of Jamaica provide sufficient funding to cover the operation and maintenance of equipment and to provide additional qualified staff.

2. Because the future for Jamaican marble as an earner of foreign exchange is so bright, it is recommended that the Government establish a marble technical centre or institute to oversee the orderly development of this resource for local and world markets, and to establish Jamaica as a "Carrara of

the Caribbean", even to the point of importing other Caribbean marbles, and finishing them in Jamaica into products for export.

3. It is further recommended that if a marble technical centre were created it should have a small, motivated and well paid staff. It should be located in a different location than the present GSD facility to provide more space, and all existing marble equipment should be transferred to it. The functions recommended for such a centre would include:

a. Promotion of local and international markets for Jamaican marble in concert with the Jamaican National Investment Promotion Company (JAMPRO);

b. Establishment of Jamaican standards for locally produced marble products to satisfy local and future export markets;

c. Researching the latest world marble industry technology to provide better assistance to local producers;

d. Seeking out international joint-venture partners, again with assistance from JAMPRO, for those local investors desiring such participation;

e. Training of marble industry workers for quarries and shops;

f. Providing active hands-on assistance in promoting and teaching environmental safeguards to new marble quarrying and other industrial minerals operations;

g. Continuing assistance to newly interested investors in opening marble businesses; and

h. Assisting banks and lending agencies in evaluating marble investment projects for requested loans.

4. The new air track drill acquired for this project can be used to great advantage by GSD for the evaluation of numerous diverse minerals, other than marble. It should be used routinely for exploration and development drilling in clay, volcanic rock, limestone, gypsum, shale, aggregate minerals and shallow metallics mineralized zones possibly containing gold. It should not be transferred to private sector operators.

5. The Geological Survey Division should follow up on other industrial minerals worthy of economic development. These include high-purity limestone, igneous aggregates, guano, ceramic-quality flux minerals and clays, and light-weight aggregate mineral resources that could benefit major construction.

6. Much more expansive evaluation of the considerable array of mining and mineral legislation of Jamaica is advisable, perhaps leading to a new Mining Act for the country.

Annex I

INVESTORS ASSISTED AND QUARRIES OPENED

Marble location	Parish	Investor 1/	Remarks
1. Fort Clarence	St. Catherine		Quarry opened
2. Mavis Bank	St. Andrew	Minex Co.	Quarry opened
3. Colbeck	St. Catherine	E. Nelson	Quarry opened
4. Red Ground	St. Catherine	R. Codlin	Quarry opened
5. Cuckold Point	St. Elizabeth	Commonwealth Marble Co. (Canada)	Quarry opened
6. Lumsden	St. Ann	King Family	Quarry opened
7. Thatch Pen	Clarendon	F. Maragh	Quarry opened
8. Brazilletto	St. Catherine	V. Hill	Assistance with sampling, large blocks taken
9. Paul Mountain	St. Catherine	K. Scott	Follow-up evaluation
10. Troy-Auchtembeddie	Manchester	G. Muirhead	Follow-up evaluation
11. Stewart Bay	Trelawny	-	Follow-up evaluation

1/ All Jamaican except as shown

Annex II

PROJECT TECHNICAL REPORTS

A. By consultants

Dalton, Diana (Canada). Recommended revisions to Jamaican mining and mineral legislation. (In preparation as of February 1992.)

Lescroart, John (United States). Potential for expanding the Marine transportation options for bulk industrial minerals to be exported from Jamaica. Open file, Geological Survey Division, 1990.

Meade, Lance (United States). Review of selected dimension stone projects - Jamaica. Open file, Geological Survey Division, 1990.

Miedecke, John (Australia). Environmental considerations for mining marble and other minerals. (In preparation as of February 1992.)

Pisani, Robert (Italy). Marketing potential for Jamaican marble. Open file, Geological Survey Division, 1991.

B. By project staff

Busby, Howard R. Marble quarry costs for Jamaica, 1990.

Ford, R. Fort Clarence marble deposit, 1991.

_____. Red Grounds marble deposit, 1991.

Ford, R. and D. Grow. Cuckold Point marble deposit, 1991.

_____. Lumsden marble deposits, 1992.

_____. Thatch Pen marble deposits, 1992.

Henry, L. Dimension stone at Brazilletto, preliminary evaluation, 1990.

_____. JJamaica's whiting potential, 1991.

_____. LLimestone resource evaluation, Norris, St. Thomas, 1990.

_____. Marble deposits, Troy-Auchtembeddie area, N.E. Manchester, preliminary evaluation, 1991.

Henry, L. and Howard R. Busby. Mineral resources for Jamaica's Five Year Plan, 1990.

Henry L. and E. Jackson. Limestone resource evaluation, Downing, Manchester, 1990.

Walder, N. Evaluation of vesicular lava rock (Low Layton lavas), 1991.

Walder, N. and R. Ford. Colbeck marble deposit, 1991.

Annex III

PROJECT PERSONNEL

A. International experts

Howard R. Busby (United States)	Chief Technical Adviser	Feb. 1990 - Feb. 1992
D. Biart (Belgium)	Assistant	Mar. 1990 - Feb. 1992

B. National technical staff

L. Henry	Director, Geological Survey Division	Feb. 1990 - Feb. 1992
C. Roache	Commissioner of Mines	Feb. 1990 - Feb. 1992
K. Black	Industrial Minerals Head	Feb. 1990 - Jan. 1992
O. Gardner	Geologist	Feb. 1990 - Mar. 1991
N. Walder	Geologist	Feb. 1990 - Feb. 1992
D. Grow	Geologist - US Peace Corps	Feb. 1991 - Feb. 1992
R. Ford	Feologist - US Peace Corps	Feb. 1991 - Feb. 1992
S. Wood	EDP Manager	Feb. 1990 - Feb. 1992
J. Thompson	Mgr. Chemical Lab.	Feb. 1990 - Feb. 1992
C. Burke	Laboratory Technician	Feb. 1990 - Feb. 1992
D. Stephenson	Laboratory Technician	Feb. 1990 - Feb. 1992
V. Simpson	Senior Lab. Tech.	-
J. Hamilton	Laboratory Assistant	-
D. Mullings	Geologic Assistant	Feb. 1990 - Feb. 1992

Annex IV

EQUIPMENT PROVIDED BY UNDP

Type	Total in US$ (rounded to nearest 10)
Air track drill with compressor and spare parts	US$ 161,460
Vehicles (2) and spare parts	38,490
Field equipment and spare parts	15,390
Marble shop equipment and supplies	2,740
Technical publications	1,120
Office supplies and computer software	1,040
Total (as rounded)	US$ 220,250