C O N T E N T S

TABLES AND FIGURES:

enclosure: Minerals Map

A B S T R A C T

Early Geological work done in Northern Belize by Flores (1952) identified fossils of Cretaceous, Paleocene-Eocene, Miocene to recent: forams, rudist fragments. Ower (1921-28) and Dixon (1956) recognised Paleozoic sediments, an igneous phase and overlying limestones. Ower concluded that these limestones were of OLIGOCENE age while Dixon favoured a Cretaceous-Eocene age.

Current work on subsurface correlation, using eleven (11) selected wells identified (16) sixteen planktonic and nine (9) benthonic Assemblage zones. From Fusilinids of Permian Age through Globorotalia opima opima of Oligocene Age, to miocene-recent Amphistegina, Miogysina (M) Globulina, Archais sp.

NINE mineral occurrences as identified by Ower, Dixon, Andrews-Jones, Souviron (1990) are discussed. The Barytes deposit found by Dixon (1951) was assessed by Andrews - Jones as being of maximum 300,000 tons of 21% Barium Sulphate.

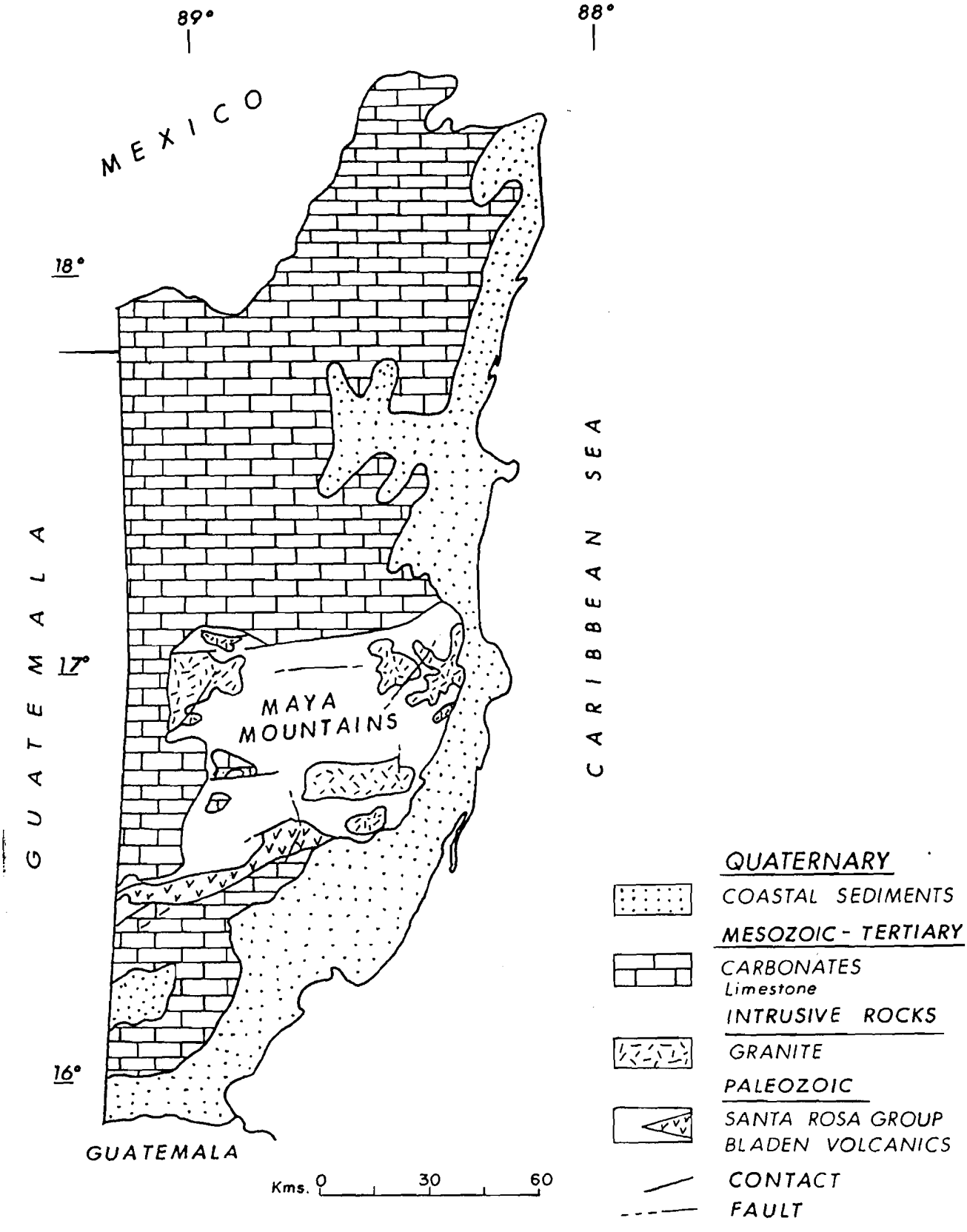
The first two meters of the South Eastern end of the Ceibo Chico alluvial fan was assessed by Souviron as being of Gold - 0.4 average grade.

Under the Mines and Minerals Act of 1988, during the period 1st January to June 1990, Sixteen (16) mineral Rights have been issued of which three (3) Exclusive Prospecting Licences were awarded to foreign companies, along with fifty (50) Quarry Permits. These awards, based on scale of operation and mineral type have generated revenues of $151,226.00 Bz..

Similar revenue collections from Petroleum Exploration totals 1.1 million Bz. $.

Under section VII, of the Mines and Minerals Act "Protection of the Environment", all large scale operators (more than 16,000 cubic yards annually) are requested to provide an Environmental Impact Study by the Minister for any proposed Mining operations.

Fig I



GENERALIZED GEOLOGIC MAP OF BELIZE

MINERAL RESOURCES - BELIZE C.A.

INTRODUCTION:

This paper attempts to review the Mineral Potential of the country of Belize from the available data, beginning with the work of L.H. Ower (1928) who reported the existence of tin in the Middlesex area through C.G. Dixon (1956) who confirmed tin and gold in Pleistocene clays at Punta Gorda, gold and other Industrial and Construction minerals including a Barytes deposit in the Maya Mountains, to A. Souviron (1990) Gold Expert who assessed the Ceibo Chico placer and vein prospects of the Chiquibul Forest Reserve.

Also, within the legal framework of the Mines and Minerals Act of 1988 to document the extraction of these minerals from the date of its Enactment (January 1st 1989) to the present.

GEOLOGY

The first attempt at interpreting the Geologic History of Belize, formerly British Honduras, was by L.H. Ower, Government geologist, who worked in the colony from 1921 -1928.

He identified sedimentary rocks of Paleozoic, Mesozoic Cenozoic Age; and volcanics. The Paleozoic sediments were intruded by acid magma a short while after deposition. The overlying limestones which extend over the whole of Northern Belize and cap the granites were said to be of OLIGOCENE Age by him and equivalent to the Rio Dulce Limestones of Guatemala. Although Ower stated that the relationship of the Rio Dulce limestone and Toledo Beds was 'obscure' (pg. 503 Geology of British Honduras) he assigned to the latter beds, a MIOCENE Age (Pg. 50 Geology of British Honduras).

Also, he mentioned that the Oligocene limestones were fossiliferous but no attempt was made to identify the fossils.

No further work was carried out in the colony until 1952 when C.G. Dixon was seconded from the Geological survey of British Guyana. Dixon's work on the Maya Mountains and Southern British Honduras is considered to be the most comprehensive, even today. He discussed the Geology of this area, documented minerals and worked on the water resources as well.

Dixon recognized Paleozoic sediments within the Maya Mountains from unidentified fossils found in a shale band in Indian Creek. These sediments he subdivided into the Macal and Maya Series. The younger Macal was of Shales, sandstone, crinoidal limestone while the Maya was comprised of metamorphics: slates and guartzites. Granites were noted also, being intruded into the older Maya Series. The Bladen Porphyry he described as being ~~intrusive~~ Extrusive.

No evidence was documented for the existence of the oligocene by Dixon. He mapped the overlying limestone and Toledo Series as Cretaceous - Eocene, Eocene respectively. The Toledo series consisted of shales, mudstone, sandstone and limestone.

The Cayo group was found to consist of boulders of limestone and grey calcareous clays with Gypsum by Dixon and were quivalent to the Cayo Marls of Ower. The white marl of Corozal and Orange Walk districts contained fossils of Miocene Age according to both Ower (Pecten plurinomius) and Dixon (Turitella).

Dixon concurred with the view of Flores, (1952) who found fossil foraminifera of the Upper Cretaceous (nummoloculina and Dicyclina sp, Rudist fragments) but no Oligocene fossils.

TABLE I

The stratigraphic Sequence which emerged could be summarized as follows:-

SYSTEM/STAGE	LITHOLOGY	LOCATION
RECENT	Alluvium	Coastal Belize
	Clays	Coastal Belize
Miocene	Marls	Cayo, Orange Walk & North Belize.
Tertiary/ Eocene	Limestone sand Stone/ shales	North Belize South Belize.
Cretaceous	Limestone	Unnamed Northern Belize.
Jurassic?	Hiatus?	
Permo/Triassic?	Igneous Rhyolites, granites, pyroclasts	Maya Mountain
Paleozoic	Sediments	
Pennsylvanian-Permian	Metasediments	Maya

~~Mountains.~~

Continuing the work of Dixon in 1970, Bateson & Hall and Duncan Derry Ltd. did prospecting work in the Maya Mountains. They concluded that the Paleozoic sediments should not be divided into the two fold Maya & Macal series. Evidence indicated that the granite intrusion affected both Dixon's Maya & Macal series. Also the samples of granite sent to be dated (M. I. T., 1968) was found to be 300 x 1000000 years old. Bateson and Hall gave the name Santa Rosa group to the Paleozoics; one unit. Flores' (1952) Fossil evidence indicated that Upper Cretaceous, Paleo-Eocene and Miocene-Pleistocene sediments were present in British Honduras. Simultaneously, Anschutz Cooperation (Denver, Colorado) carried out further prospecting of the Maya Mountains.

This Cooperation supported the regrouping of both of Dixon's series into one, Santa Rosa. Subsurface studies carried out under project UNDP/BZE/001 by the Technical Personnel of the Geology and Petroleum Office from 1984 to the present, using eleven (11) selected wells greatly assisted in arriving at the present day stratigraphic correlation (Nair, Ramanathan and Cornec).

Rao (1982) divided the country into two major basins located in the North and South and separated by a central uplifted block the Maya Mountains. These were named the ~~Coroal~~ Corozal and Belize Basins respectively.

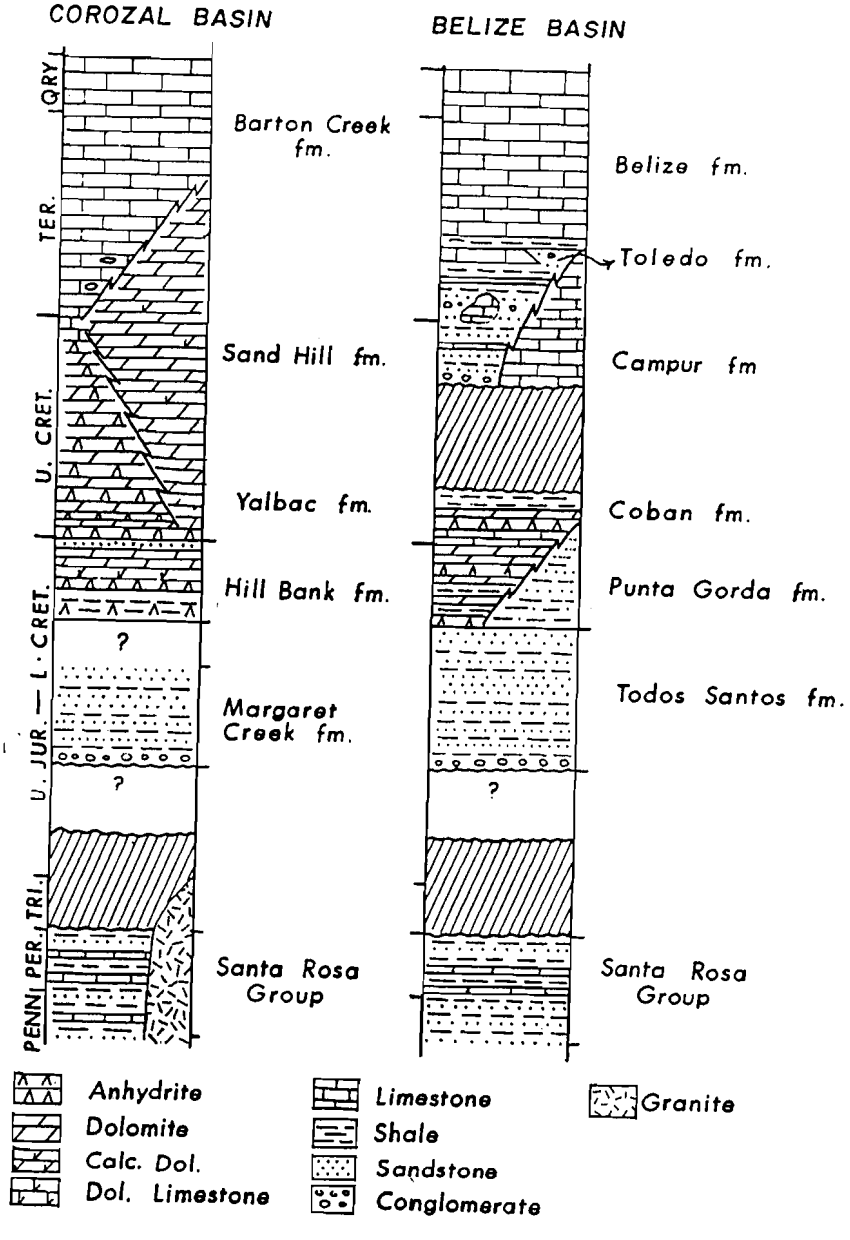
Foraminiferal micropaleontological work by R. Ramanathan identified sixteen (16) assemblage zones for Plankthics and nine (9) for Benthics in Belize. He produced evidence for the existence of the Oligocene in the subsurface. From the offshore Spanish Lookout-1 and Turneffe-1 wells; Globorotalia opima opima, Gr.kugleri, Miogysina (M) complanata, Nummulites sp. and Lepidocyclina were reported at depths 3440'- 3490' Spanish Lookout

Well and 2900' - 3620'Turneffe.

FIG II

STRATIGRAPHY OF BELIZE (SUBSURFACE CORRELATION)

COROZAL BASIN BELIZE BASIN



The Santa Rosa group had been encountered in almost all the wells of the Corozal Basin and a few of the Belize Basin. From cutting samples, fusilinids (parafusilina) indicative of age Pennsylvanian-Permian were obtained.

The overlying Todos Santos red beds of the Belize Basin are equivalent to the Margaret Creek sandstone and conglomerate of the Corozal Basin and are probably of Jurassic Age.

The Coban/Punta Gorda Hillbank/Yalbac Formations contain fossil forams Hedbergella planispira, Rotalipora apennenica and Globotruncana species of the Albian-Aptian? to Lower Campanian age.

The Tertiary limestones and marls are designated as Barton Creek and Belize Formations, in the Corozal/Belize Basins.

M I N E R A L O C C U R R E N C E S

ALLUVIUM

Five major rivers bring gravels, sands and clays which are presently being eroded from the sediments, metasediments and volcanics of the Maya Mountains. The sediments are deposited along the many meanders and bars. These are mined by operators and used extensively in the Construction Industry in Belize. These rivers are the Belize, Sibun, North and South Stann Creek and Monkey river. The coastal clays were identified as being mainly of kaolinite (and muscovite) with up to 60% koalin.

BARYTES

In 1951 (April) Dixon found this mineral at First Creek near to the then Saw Milling operations at San Luis. This deposit, thought to be hydrothermal by Dixon at the time was subsequently assessed by Andrews-Jones as hydrothermal with replacement (1977) along a Northwest-Southeast fracture zone. This, occurring at the contact between the granite and overlying cretaceous limestone. Barytes was associated with extensive quartz veins which were "amethystine" in several places. (Geology of Southern British Honduras pg. 64, Dixon)

Andrews-Jones arrived at a maximum value of 300,000 tons of Barytes using an average thickness of 35' and area of 2,000'x150'. Initial surveys gave volume as high as 84% Barium Sulphate, further analysis arrived at a grade of 21% Barium Sulphate.

The final recommendation by Andrews - Jones was that there should

be follow up work along other areas of contact between the granite and limestone for possible further deposits.

CASSITERITE (TINSTONE)

Both Ower and Dixon reported finding "traces of tin"; samples from fifteen streams (of the Maya Mountains) were recorded by Dixon. In 1951 the London Tin Cooperation under a Prospecting Licence did some analysis in the North Stann Creek River only. Dixon 's work was centered in the Maya Mountains and he admitted that the Cockscomb area was never surveyed. The London Tin Cooperation results indicated that the quantities in the North Stann Creek River was uneconomical.

DOLOMITE

Replacement of calcium with magnesium ions in some of the Cretaceous limestones has produced dolomite as noted in the hills of Punta Gorda (Saddle Hill) and St. Margarets Creek. Analysis indicated that the Magnesia content was 21.74% and 21.78% respectively. Recent reports (Personal Communication Brorsen and Holland 1990) indicated over 30% magnesium carbonate in samples taken during the first field season under Exclusive Prospecting Licence No. I of 1990.

GOLD

Ower (Silica Lines of British Honduras) and Dixon reported gold occurrences; the latter in the Macal River and Chiquibul areas. In 1955, gold colours were found in the river bed at Ceibo Camp and tests were carried out on the gravels of Ciebo Chico Creek in 1955,(pg 61 Geology of Southern British Honduras, Dixon). Gold values from several pits averaged 2 dwts of gold per cubic yd.

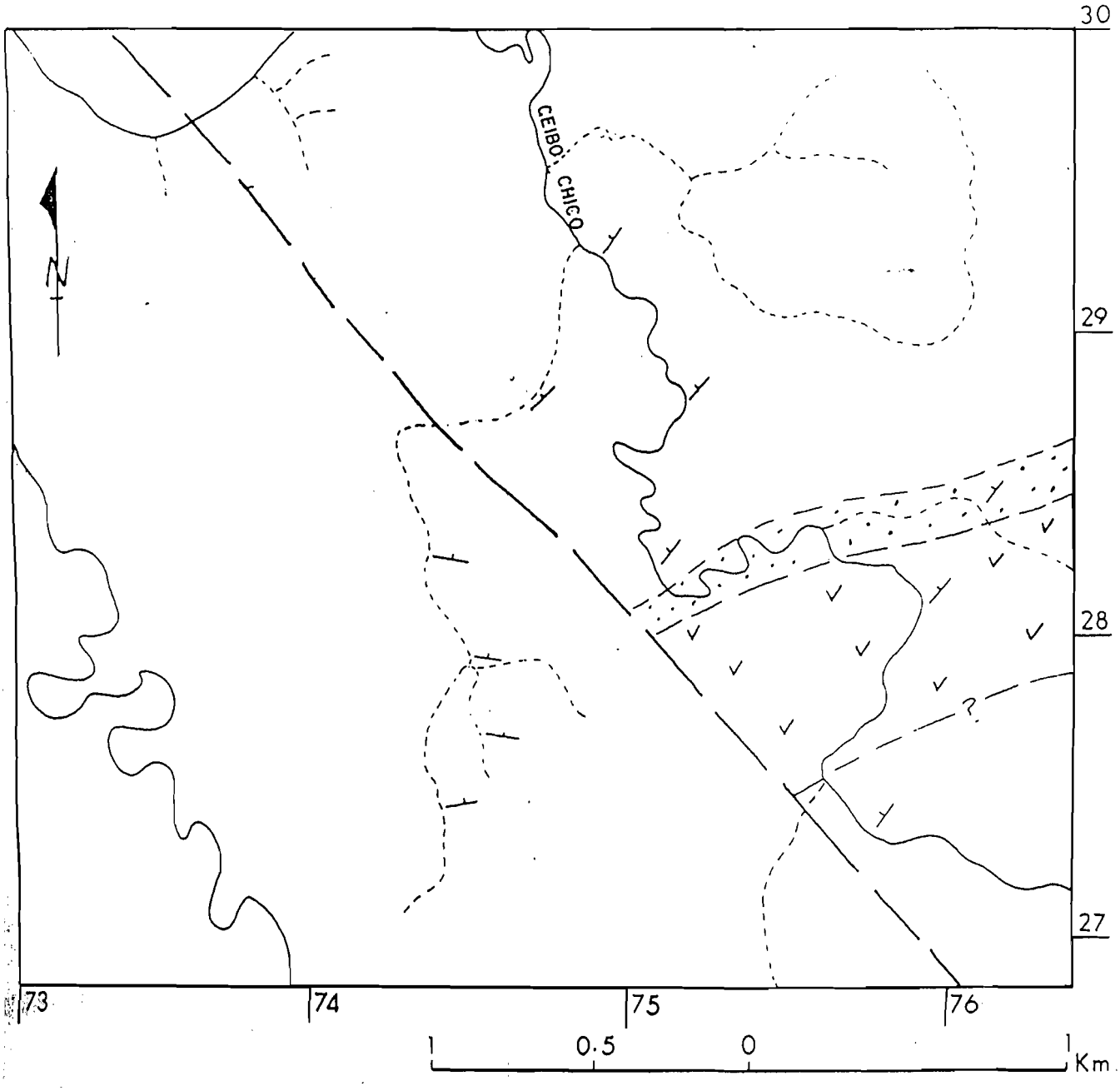
Dixon noted that the coarse, rolled gold was associated with quartz containing arsenopyrites but did not trace it to its source. Under a UNDP funded project during the field season of 1988/89/90 A. Souviron, R. Ramanathan and B. Graham collected stream sediments and vein samples from the Ciebo Chico placer and quartz veins,(16) and (35) respectively. These quartz veins were found to be in argillites which were in contact with the rhyolites and dacites of the Bladen Volcanics, see fig III, after Souviron, follow up report (pg 8) 1990. The quartz veins were determined to be widespread but only weakly mineralised while analysis of the first two (2) meters of the Ciebo Chico placer indicates reserves of average grade .4.

The final recommendations are:

(i) that testing on a tighter grid of the Ciebo Chico be carried out through a leasing arrangement via Mineral Rights award.

(ii) Further work should be done in the areas favourable for gold Mineralisation: the headwaters of the Western Tributary of the Ciebo Grande River, the Metasediments near to the Bladen Volcanics and the calcareous facies of the Santa Rosa Gp. North and West of Richardson Peak.

Fig III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CEIBO CHICO
N
1 0.5 0 1 Km
Argillites
Quartzites
Volcanics & Quartzites
Strike & Dip of bedding
Fault
Creek & Tributary

GRANITE

Five Granitic Plutons outcrop in the Maya Mountains, Cockscomb Basin, Mountain Ridge and Hummingbird areas of Belize there exist a Grey as well as Pink, Porphorytic variety. There is the potential for construction material as volumes known to exist are equivalent to Limestone, mentioned below.

GYPSUM

Gypsum is found in the clays as veins as well as massive deposits all along the beds of the Mopan and Belize Rivers at Cristo Rey , Young Gal, Ramonal and Spanish Lookout of the Cayo District. No assessment has been made of this mineral.

LIMESTONE

Over Seventy five percent (70%) of the exposed rocks in Belize are carbonates and in most cases 98% soluble in hydrochloric acid.

MOLYBDENUM

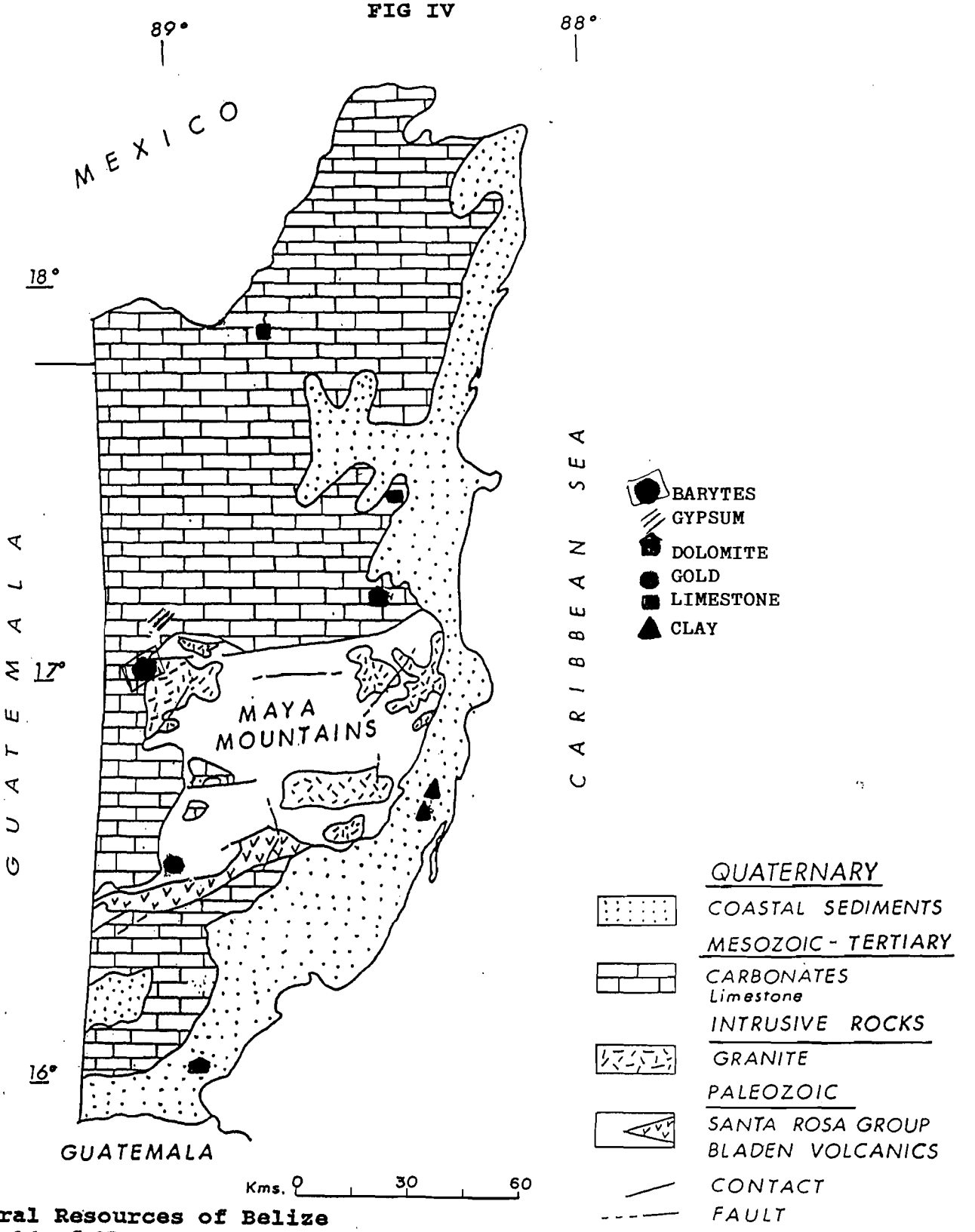
Anomalous values for Molybdenum was recorded from the Cabbage Haul Gap area and Andrews - Jones had recommended further work in this area. To date this has not been done.

ZINC (Copper, Lead)

Anschutz Cooperation reported anomalous values for Lead, Zinc & Copper in the Cabbage Haul Gap Area of Mountain Ridge. Geological Minerals Ltd under E.P.L # 9 1989 commences phase III of their prospecting programme which will be using geophysical equipment to narrow the grid in order to delineate a potential ore body. (Nov 1990)

MINERAL OCCURENCES - LOCATION OF MINES/QUARRIES

FIG IV



P E T R O L E U M

Having discussed the hard minerals known to exist, a brief discussion of the Petroleum Potential follows:-

During 1954 to 1985, 47 wells have been drilled and the Roaring Creek -2, Belmopan -4 and Eagle-1 wells of Belmopan have produced sub commercial quantities of crude of A.P.I value 32°.

From the unpublished reports of UNDP/BZE/001 it has been postulated that the source rocks could be the Todos Santos of Jurassic Age or the black shales associated with the (a) Coban dolomites and (b) sandstones/carbonates of the Toledo formation.

The latter has been determined to be turbidite facies equivalent to the Campur carbonates. Ramanathan reported GLOBOTRUNCANA fornicata, G. linneiana suggestive of a deep marine trough.

The Reservoir rocks are the Upper Coban Limestones of the Southern Belize Basin and Yalbac formation of the Northern Corozal Basin. Porosities values of the Yalbac range from 15/30% (Nair and Cornec 1985).

The anhydrites of Late Cretaceous to Early Tertiary could be cap or seals.

One new well is currently being drilled onland near the Spanish Lookout area of the Corozal Basin. This basin with over 20,000 ft. of sediments has its depocentre in the Blue Creek sub-basin. The Belize Basin has over 16,000' of sediments. The Blue Creek sub basin was not explored before as access is difficult and very little seismic work has been done.

THE MINES AND MINERALS ACT OF 1988

With the passage of the Mines and Mineral Act of 1988 the Government of Belize possessed a legal framework to assist in its renewed efforts to monitor its fledgling mining industry.

The basic premise of the Act is that all minerals in Belize are vested in the Crown. Old titles with grants to mineral rights (implied or explicit) became null and void after a grace period of one year, effective January 1st, 1990.

During the past year, these title holders were given the right to develop their mineral rights. The general scheme of the Act is based on (a) scale of intended operation and (b) mineral type. Under a Mineral Right, a potential operator may do reconnaissance work, prospect (with exclusivity) and eventually mine minerals, volumes which must exceed 16,000 cu yds annually: small scale operators can not extract more than 16,000 cu yds. This classification applies mainly to the construction and industrial minerals.

For the precious and other minerals, small scale extraction may occur via a claim licence. All these licences and/or permits are awarded over a fixed acreage, e.g. an Exclusive Prospecting Licence may not exceed 25 km, (approximately 6,200 acres), a Mining Licence may not exceed 10 sq km (approximately 2,470 acres), while a Claim Licence may not exceed 20 acres.

These values were arrived at, bearing in mind that the area of potential mineralization - the Maya Mountain occupies about 33% of onland acreage of Belize.

The maximum duration of the mining licence is 20 years with possible renewal depending on the life of the deposit. While a Registered Quarry Permit lapses after one year.

An administrative fee is charged on the award of a Mineral Right, permit, and other licences. The values tabulated below are from the Subsidiary Legislations of the New Mines and Minerals Act.

TABLE II

TYPE OF PERMIT/LICENCE	ADMINISTRATIVE FEE	
	Local Operator	Foreign Operator
Registered Quarry Permit	$100.00 Bz.	$100.00 U.S.
Non Exclusive Prospecting Licence (Individual)	$50.00 Bz.	$50.00 U.S.
Non Ecxclusive Prospecting Licence (Company)	$200.00 Bz.	$200.00 U.S.
Claim Licence	$300.00 Bz.	$200.00 U.S.
Recconnaissance Licence	$250.00 Bz.	$250.00 U.S.
Exclusive Prospecting Licence	$300.00 Bz.	$300.00 U.S.
Mining Licence	$500.00 Bz.	$500.00 U.S.

Royalties: The following royalties shall be paid:-

(a) Industrial and Construction minerals 3% advalorem on Government Land and 2 1/2 % on Private Land.

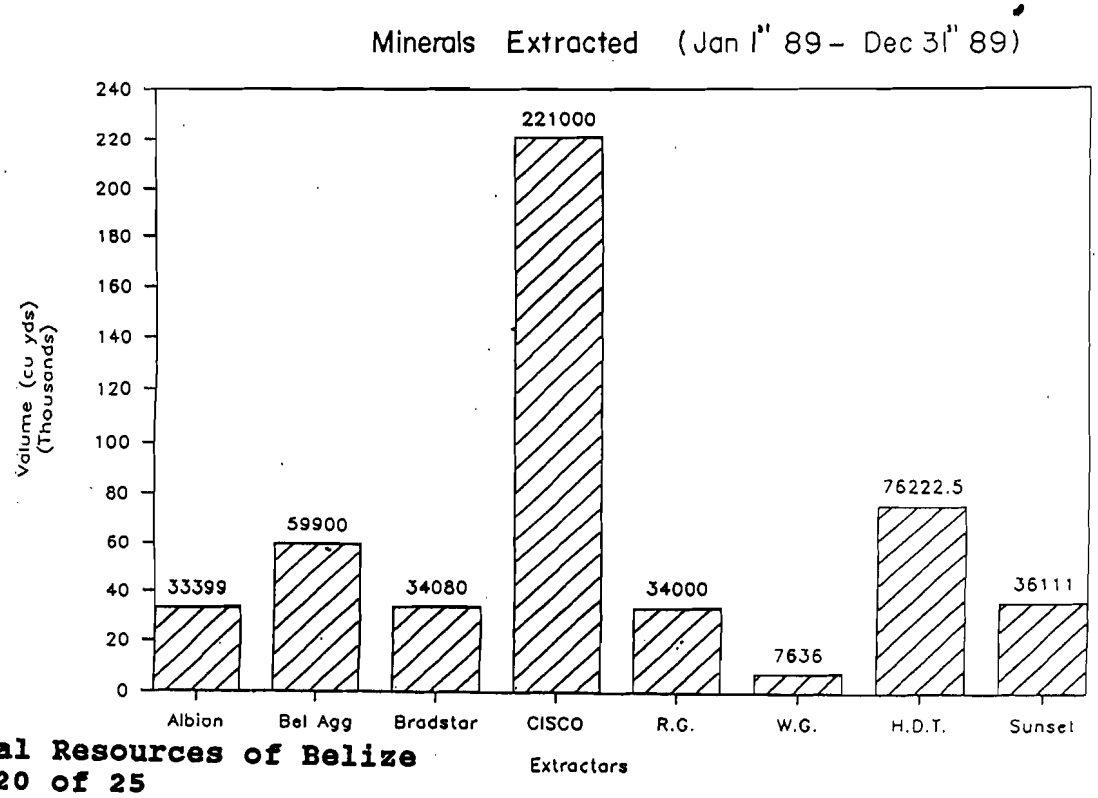
(b) Precious Minerals 5% ad valorem.

REOCRD OFVOLUME EXTRACTED - 1989

Name	Volume extracted in Cu. yds.	Jan - Dec.	Jan. June
Albion Stone Company Ltd.	33,399		
Belize Aggregates ltd.	59,900		
Bradstar Construction Supplies	34,080		
Rudolph Gillett	34,000		
William Gillett	7,636		
Sunset Coves Ltd.	36,111	N.A.	
H.D. Thompson	76,222.50		
Cisco Construction	221,000 *		
TOTAL	502,348.5		
Ashland Gold Mines Ltd	-	-	37.0

* No royalty levied as marl was extracted for road rehabilitation on behalf of the Government of Belize.

Figures Reported for period Dec - July (1989) in troy ounces



Where exclusivity is desired by an operator, a rental for mineral rights is charged: $10.00 BZ per acre. Royalty is levied on all minerals extracted at the rate of 5% ad valorem (Precious and other minerals) and 3% ad valorem (Construction/Industrial Minerals).

Within this framework, since January 1st, 1989, eight local companies have been awarded Mining Licences for construction or industrial minerals; river gravel, sand and limestone. Three foreign companies hold Exclusive Prospecting Licences for base, metals, clay and limestone and one local company should commence mining in the Ceibo Chico area by September 1st, 1990. Volumes of minerals extracted are recorded in Fig. VI, for the year 1989.

Numerous Belizeans are involved in the quarry business, while one group, the Belize Whitelime Society converts dolomitic limestone to agricultural lime. One foreign company has done preliminary prospecting on the Punta Gorda dolomites and has since applied for an Exclusive Prospecting Licence.

For the Fiscal Year 1989-1990, monies generated from oil prospecting totalled $1.1 million BZE, while the mining industry $151,226.00 to date.

FUTURE WORK

In collaboration with the Government of Mexico, a final analysis of the Maya Mountains will be made based on the recommendations of Andrews - Jones A. and Souviron.

ENVIRONMENTAL

As the Mining industry develops special attention will be made to the effects of (1) dredging, especially along coastal Belize as the

Barrier Reef is only 15-20 miles offshore, coming ashore at Mexico Rocks on SAN PEDRO, AMBERGRIS CAYE.

(2) Large scale onland mining as proposed by two companies presently holding Exclusive Prospecting Licences. Here the major problem would be powdered limestone/dolomite finding itself in suspension into the many pure streams and rivers which flow from the Maya Mountains in the west to the sea.

It was recommended that before issuing a Mining Licence to these companies the Minister requests Environmental Impact Studies. Also, all quarries, on cessation of quarrying activities be either infilled, rehabilitated or converted into ponds. These recommendations have the support of the Minister of Industry and Natural Resources.

Finally, it is hoped that once the mineral reserves have been documented, these will be exploited in such a manner that Belizeans obtain a fair return and the Belizean environment is enhanced rather than degraded by mining of its minerals.

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A C K N O W L E D G E M E N T S

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EVADNE GARCIA

26th July, 1990