A BAUXITE GEOLOGICAL MODEL OF TROPICAL OCEANIC ISLAND ARCS

by

LÁSZLÓ KORPÁS D. Sc. C.

ERRATA

p. 6. par. 3. favourable — unfavourable
p. 7. par. 6. evolutionarystages — evolutionary stages
p. 13. ostvacan — ostuacan
Manga Largo — Manga Larga
Tranquilidaa — Tranquilidad
p. 19. 1500000 — 1:500 000

SPECIAL PAPERS
INVESTIGATIONS IN FOREIGN COUNTRIES: METHODS AND APPLICATIONS

BUDAPEST, 1989/1

Criticism and suggestions made by

GY. BÁRDOSSY Ph. D. Ac.
J. HAAS Ph. D. C.

Editor-in-Chief

M. DEÁK Ph. D.

Translated by

† B. KECSKÉS

Responsible Publisher

G. HÁMOR D. Sc. Ac.
Director
of the Hungarian Geological Institute

INTRODUCTION

It has become a general practice in the literature devoted to bauxite geology that the occurrences of bauxite are, primarily and almost exclusively, grouped in terms of genetic principles. In spite of the emphasis almost all authors of bauxite geological syntheses laid during the past one decade and a half on the need for classifying them according to structural position (G. I. BUSHINSKIY 1971, 1975, I. VALETON 1972, V. M. MIKHAILOV et al. 1973, GY. BÁRDOSSY 1977, 1982, G. R. KIRPAL' 1980, GY. BÁRDOSSY 1981), such an attempt has been made by few as yet. In the wake of A. V. PEYVE (1947), in the Soviet literature, the classification of bauxite deposits based on their belonging to platform and geosynclinal zones has found general acceptance. GY. BÁRDOSSY (1973, 1979, 1981, 1982) was the first to introduce the global tectonic models that had appeared in the late 1960's and that had been used more and more widely ever since, and to apply them to bauxite geology at large. It was himself who, in addition to the continental and orogenic zones, singled out island arc-type bauxite deposits as an independent type. In this paper, paying due attention to GY. BÁRDOSSY's work just referred to, I have made an attempt, taking advantage of the example of the bauxite occurrences in the Caribbean, at developing the bauxite geological model of tropical oceanic island arcs.

METHODOLOGICAL FUNDAMENTALS

In working out the model under consideration, I have relied in the first place published data, in the second, on the observations and experience in Cuba—one of t examples of the Antilles' island arc. The evaluation has been aimed at singling out stag suitable for bauxitization and bauxite accumulation in the history of birth and evol tion of oceanic island arcs and at delineating in this context structural-morphologic units that may be regarded as favourable. Considering the general regularities of bau itization and bauxite accumulation, my task is thus to specify the evolutionary stag and morphostructural units of platform—quasiplatform behaviour.

To achieve this goal, using a part of the extensive methodological literatu available, I have developed a model of the birth and development of tropical ocean islands arcs (Fig. 1) that makes it possible to assess them bauxite geologically. T works I relied on in the modelling had been authored primarily by W. J. Ludwig et (1966), D. E. Karig (1970, 1972, 1974), A. H. Mitchell—H. G. Reading (1971), R. Dickinson (1973, 1974, 1976), M. S. Marlow et al. (1977), R. G. Coleman— P. Irwin (1974), W. G. Ernst (1974), K. J. Hsü (1974), A. E. Ringwood (1974), R. Seely et al. (1974), D. E. Karig—G. F. Sharman III (1975), G. F. Moore—D. Karig (1976), D. R. Seely (1977, 1979), J. S. Watkins—C. L. Drake (1983). In add tion, a number of collections dealing with oceanic basins and continental margins (A. Burke—C. L. Drake 1974, R. H. Dott Jr.—R. H. Shaver 1974, A. E. M. Nairn- F. G. Stehli 1974, 1975, M. Talwani—W. C. Pitman 1977, National Academy Sciences, Washington D. C. 1979, J. S. Watkins et al. 1979, J. S. Watkins—C. Drake 1983) and publications devoted to similar subjects (W. Hamilton 1977, D. Hall et al. 1983, B. Bijou Duval et al. 1983, R. S. Lu et al. 1983) have been take into consideration.

With a view to the quoted works alone, the conclusion may be drawn that th major tectonic position of the island arcs, their kinetics—geodynamics, size dimension internal morphostructure and petrogenesis, as epitomized by modern and ancient e amples, are by and large clear. In spite of this, the interpretation of a good many details of the topics just listed is still controversial. Since these questions, in my opin ion, are irrelevant or of little relevance from the viewpoint of bauxite geology, they wi not be discussed in more detail.

In connection with the island arc development model adopted (Fig. 1), I shoul like to make the following remarks:

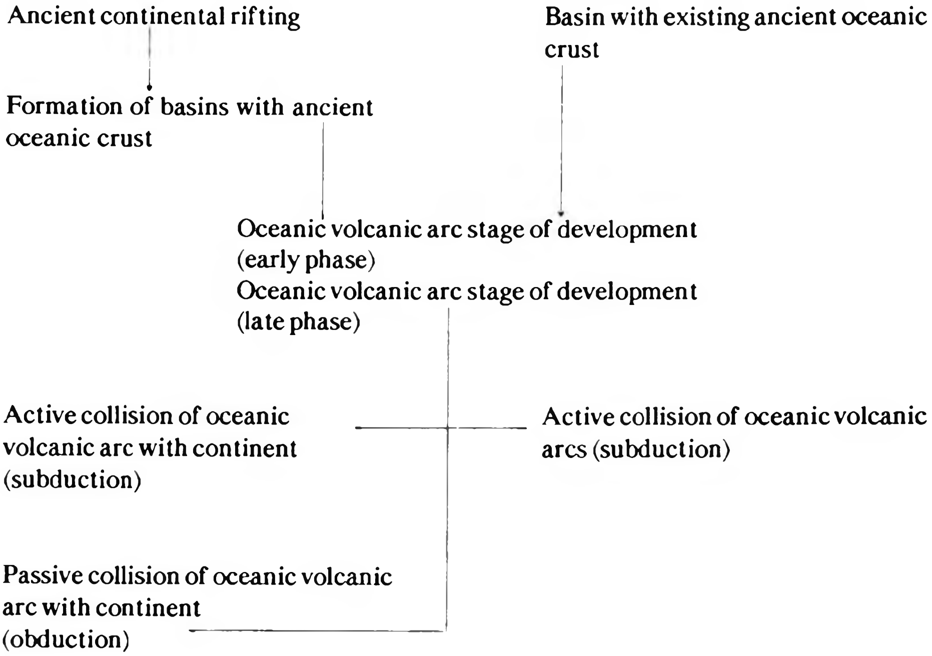
— When the model was being worked out, the assessment of the island arc was no restricted to its confines, but the continental margins were also taken into consideration

— The simplest possible solutions were conciously sought after and the numerous other combinations were left unrepresented. Thus the question of rifting of the oceanic crust, a possibility that may have existed during evolution, has not been dealt with Changes in the polarity of the subduction of oceanic plates and their consequences have not been examined. The problem of a succession of superimposed island arcs and their possible interaction with active or passive continental margins have not been analyzed

— In my presentation of the evolutionary stages, the nature, type and mechanism of the associated sedimentation and accumulation are not discussed.

—The climatic conditions for bauxitization and bauxite accumulation are regarded, as a working hypothesis, as having been a priori favourable in each evolutionary stage.

Thus the stages in the formation and evolution of island arcs the author has distinguished as typical include:



STAGES OF EVOLUTION AND THEIR BAUXITE GEOLOGICAL IMPLICATIONS

As the first landmark in the history leading to the formation of an oceanic island arc, the ancient continental rifting stage (Fig. 1, Profile A_1) is discussed. This process includes the disintegration of the ancient continental platform (craton) with the concomitant progressive attenuation of the normal continental crust. The sedimentary basins of the platform are of continental, transitional or epicontinental facies, while those parts of the platform rising above the base level of erosion are subject to subaerial weathering. In terms of bauxite* formation and accumulation, the whole area of the craton may be regarded as favourable. Above cratonic source rocks of proper lithology and morphological setting, in-situ lateritic bauxite may be formed, whereas the edges of the main transitional and epicontinental sedimentary basins of the continental margins may be reckoned with as areas of karstic bauxite formation.

Continental rifting may lead to formation of basins with an ancient oceanic crust (Fig. 1, Profile A_2) with a continental margin consisting of remainders of an earlier platform on either flank and with a zone of continued rifting (this time already belonging to a mid-oceanic ridge) in its central part. Only the continental margins may be regarded as favourable from the viewpoint of bauxite geology, the prerequisites for lateritization and the formation of karstic bauxite here being granted. The oceanic basin and the bauxite prospects of the mid-oceanic ridge in the evolutionary stage under discussion are taken to have been negative.

As the first landmark in the process that led to the formation of the oceanic island arc, an ancient basin with existing oceanic crust is reckoned with from the very outset (Fig. 1, Profile B). The whole area of that basin is taken to have been favourable for the formation and accumulation of bauxite.

The oceanic volcanic arc stage of development (Fig. 1, Profiles C_1, C_2) may be the result of either of the two afore-outlined processes. The morphostructural units of the volcanic arc of the early phase (Profile C_1) are regarded as having been unsuitable for bauxite formation or accumulation both all together and individually, in spite of the fact that the volcanic arc itself in general and the accretion wedge in particular may have got, in form of island or island groups, under subaerial circumstances. All the morphostructural units associated with the late-phase volcanic arc (Profile C_2) are simi-

---

* In the discussion of the genetic types of bauxites the classification proposed by G. R. KIRPAL' (1980) is adopted

larly rated as having been unfavourable. The bauxite geologically negative rating of the active volcanic arc is explained in the first place by the lack of tectonic stability of the high-perched morphostructural units involved. On the contrary, the continental margins flanking the active volcanic arc on both sides, at a great distance from it, are considered, as already expounded in the foregoing, to have been suitable for bauxitization and bauxite accumulation.

The next discussed landmark in the evolutionary history is the case of active collision of the oceanic volcanic arc with the continent (its subduction) (Fig. 1, Profile D) The old continental platform (craton) and its margin and the so-called "quasiplatform" that evolved within the already passive (extinct) volcanic arc are rated as having been bauxite geologically promising. Both morphostructural units are characterized by a relatively elevated structural position and the relative tectonic stability (quiescence) needed for bauxitization and bauxite accumulation. The craton and its margin have essentially the same bauxite geological characteristics as are typical of Profile A2. On source rocks corresponding in lithology to the "quasiplatform" area (volcanics and intrusives of the passive arc and ophiolites of the passive accretion wedge), lateritic bauxite may have been formed, whereas on the margin of the transitional-epicontinental sedimentary basin the formation of karstic bauxites may be reckoned with. The remaining morphostructural units of the evolutionary stage under discussion are rated as being bauxite geologically unfavourable.

The passive collision (obduction) of an oceanic volcanic arc with the continent may result in the formation of a young continental platform or, in other words, a composite neoplatform (Fig. 1, Profile F). With a somewhat schematical approach this composite neoplatform may be said to be constituted by the ancient craton on the one hand and by the oceanic crust obducted upon it on the other and, thirdly, by the earlier "quasiplatform" (= passive volcanic arc and passive accretion wedge) that has accretionally coalesced with the former. On account of its favourable topographic setting and proper source rock lithologies (volcanics and intrusives of craton, obducted oceanic crust and passive arc, ophiolites of passive accretion wedge) a considerable part of the young continental platform area is suitable for bauxite formation and accumulation. Karstic bauxites, if any, are expected to occur primarily in the marginal, transitional and epicontinental facies zones of the accretion neoplatform. The oceanic basin in the foreland of the young platform is regarded as being unsuitable for bauxite formation and accumulation.

As the second possible landmark in the history of evolution, the active collision (subduction) of oceanic island arcs is looked at (Fig. 1, Profile E). In this case it is the "quasiplatform" that came into existence within the older, now passive (extinct) volcanic arc that is rated as being bauxite geologically favourable, similar to what has been described in Profile D. In the light of the foregoing, the other morphostructural units are rated as unfavourable from the bauxite geological point of view.

Evaluating summarizingly the geological fundamentals for bauxite resources prediction based on the formation and development of tropical oceanic island arcs, let us conclude

— that of the evolutionary stages that (may have) preceded the birth of a volcanic arc it is the stage of early continental rifting responsible for the formation of the ancient oceanic basin (Fig. 1, Profiles A_1, A_2) that may be regarded as having been favourable fo bauxite formation and accumulation,

— that, in the active volcanic arc development stage, only the continental margins may be taken bauxite geologically into consideration (Fig. 1, Profiles C_1, C_2),

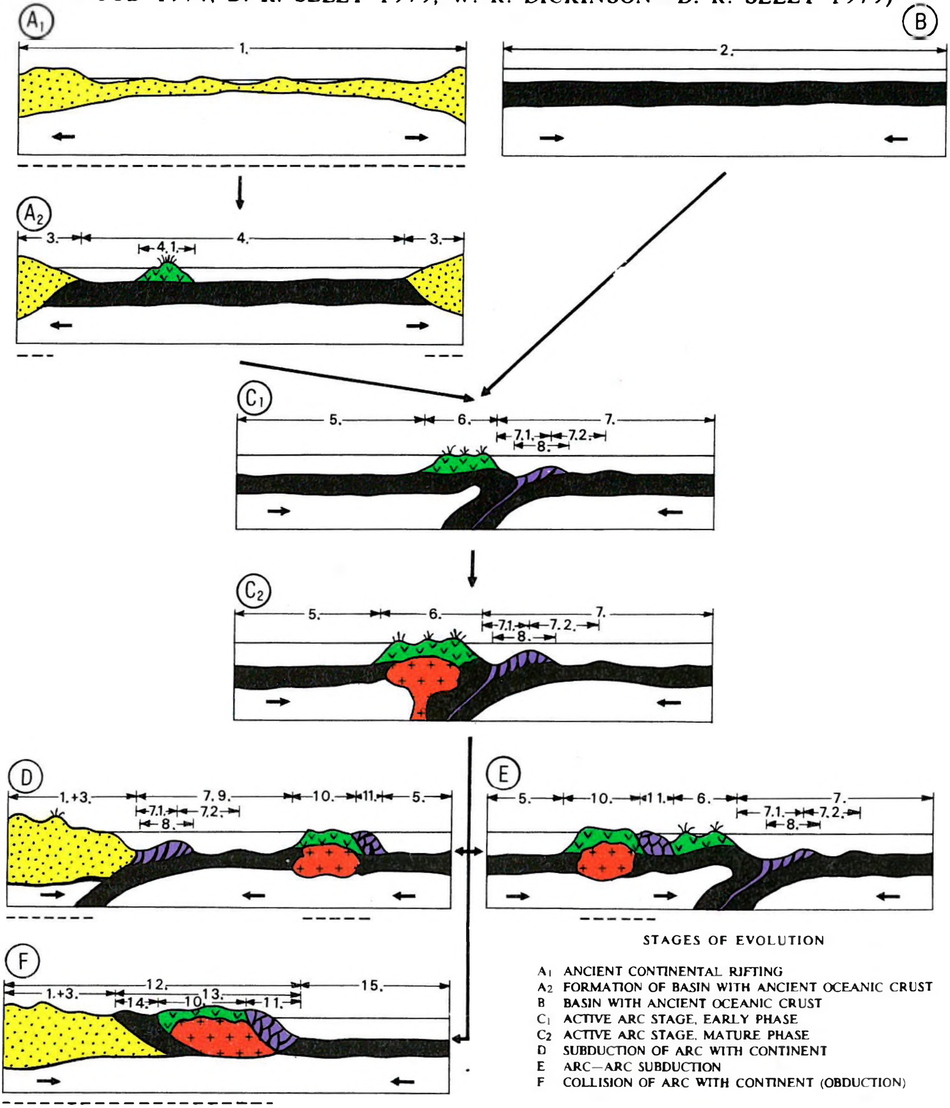
— that of the evolutionary stages that (may have) followed the extinction of volcanic arc, it is the active (subduction) or passive (obduction) volcanic arc versus continent collision and the active collision of older and younger volcanic arcs (their subduction) that may be rated as having enabled the formation and accumulation of bauxit (Fig. 1, Profiles D, E, F)

— The bauxite geologically advantageous units of the above evolutionary stage include:

— Early continental rifting stage	— ancient continental platform (craton)
— Stage of formation of basin with ancient oceanic crust	— ancient continental platform (craton) and margin
— Oceanic volcanic arc stage	— continental margin(s)
— Active oceanic volcanic arc versus continent collision stage	— ancient continental platform (craton) and margin and "quasiplatform"
— Passive oceanic volcanic arc versus continent collision stage	— young continental platform and margin of accretion type
— Stage of collision of active volcanic arcs	— "quasiplatform"

MODEL OF FORMATION AND EVOLUTION OF OCEANIC TROPICAL ISLAND ARCS

(Compiled by L. KORPÁS 1985 on the basis of A. H. MITCHELL—H. G. READING 1971, D. E. KARIG 1972, 1974, W. R. DICKINSON 1973, 1974, 1976, A. E. RINGWOOD 1974, D. R. SEELY 1979, W. R. DICKINSON—D. R. SEELY 1979)



STAGES OF EVOLUTION

A1 ANCIENT CONTINENTAL RIFTING
A2 FORMATION OF BASIN WITH ANCIENT OCEANIC CRUST
B BASIN WITH ANCIENT OCEANIC CRUST
C1 ACTIVE ARC STAGE, EARLY PHASE
C2 ACTIVE ARC STAGE, MATURE PHASE
D SUBDUCTION OF ARC WITH CONTINENT
E ARC—ARC SUBDUCTION
F COLLISION OF ARC WITH CONTINENT (OBDUCTION)

OTHER SYMBOLS

▨ Continental crust
■ Oceanic crust
▨ Subduction complex
🟩 Volcanites
🟥 Intrusives
→ Relative plate motion
– – Favourable morphostructural units for bauxite formation
— Sealevel

EXPLANATIONS

MORPHOSTRUCTURAL UNITS

1. Ancient continental platform (craton)
2. Ancient basin with oceanic crust
3. Ancient continental platform (craton) and margin
4. Opened oceanic basin
4.1. Mid-oceanic ridge
5. Back-arc (interarc) basins
6. Active volcanic arc
7. Fore-arc (interarc) basins
7.1. Trench
7.2. Slope
8. Active accretionary prism (subduction complex)
9. Fore-arc, marginal basins
10. Passive volcanic arc
11. Passive accretionary prism (subduction complex)
12. Modern continental platform and margin
13. Accretionary neoplatform
14. Obducted oceanic crust
15. Modern oceanic basin

Fig. 1

Table1

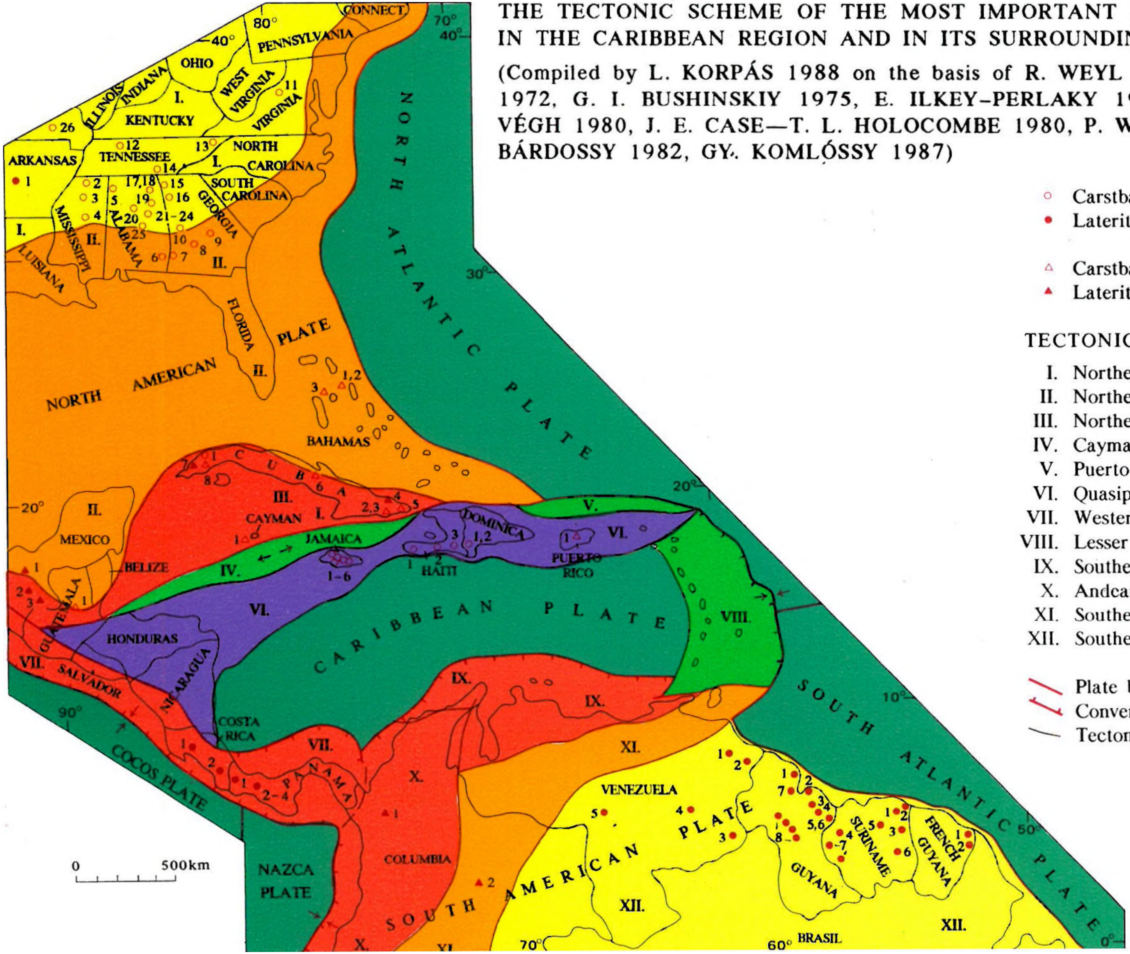
THE CLASSIFICATION OF SOME BAUXITE OCCURRENCES IN THE CARIBBEAN REGION AND IN ITS SURROUNDINGS, ON THE BASIS OF THEIR TECTONIC—MORPHOLOGICAL SETTING AND STAGES OF EVOLUTION

Stages of evolution	TECTONIC SETTING							
	CONTINENTAL				OCEANIC			
	Favourable morphostructural units	Bauxite deposits and indications			Favourable morphostructural units	Bauxite deposits and indications		
		Name and geographic position	Genetic type	Age		Name and geographic position	Genetic type	Age
A_{1-2} Ancient continental rifting	Southern continental margin	CUBA Tranquilidad (8)	carstic, intraformational	Upper Jurassic	—	—	—	—
B Basin with ancient oceanic crust	—	—	—	—	—	—	—	—
C_{1-2} Active arc stage (early and mature phases)	Northern craton and continental margin	CUBA Sierra Azul–Pan de Guajaibon (1)	carstic, intraformational	Albian—Cenomanian	—	—	—	—
		UNITED STATES Indian Mound (12) Chattanooga (14) Margerum (5)	carstic	Upper Cretaceous—Paleocene				
		Irvinton (9) Warm Spring (10)		Upper Cretaceous—Lower Eocene				
		Tippah Benton (2) Pontotoc (3) Winston—Noxubee–Kemper (4) Eufala (6) Springsvale (7) Andersonville (8)		Lower Eocene				
	Southern craton	VENEZUELA Pijiguaos (5)	lateritic, lateritic—terrigeneous	Upper Cretaceous?				
		GUYANA Pomeroon (1) Essequibo (2) Mackenzie (3) Ituri (4) Kwakwani (5) Canje (6)		Upper Cretaceous—Paleocene—Eocene				
		SURINAME Suriname River (1)		Paleocene—Lower Eocene				
		FRENCH GUYANA						

D Subduction of arc with continent	Western accretionary neoplatform	COSTA RICA San Isidro General (1) PANAMA David (1) Las Lajas (2) Tole (3) Las Palmas (4)	lateritic	Upper Miocene—Quaternary	—	—	—	—
E Arc—arc subduction	—	—	—	—	Northern accretionary neoplatform	CUBA Moa-Baracoa (4) Mantua (7)	lateritic	Upper Oligocene—Quaternary
						Guantanamo-North (2) Guantanamo-East (3)	carstic, in part intraformational	Upper Oligocene—Lower Miocene; Miocene—Quaternary
						Maisi (5)		Middle—Upper Miocene; Miocene—Quaternary
					Quasiplatform	JAMAICA Saint-Ann (1) Cockpit-Country (2) Essex valley (3) Manchester (4) Clanderon (5) Saint Catherine (6)	carstic	Miocene—Pliocene
						HAITI Massif de la Hotte (1) Miragoone (2) Rochelois (3)		
						DOMINICA Sierra de Bahoruco (1) Las Mercedes (2)		
F Collision of arc with continent (obduction)	Northern continental margin	BAHAMAS Eleuthera (1, 2) New Providence (3)	carstic	Pliocene—Quaternary	—	—	—	—
		CUBA	carstic	Lower				

THE TECTONIC SCHEME OF THE MOST IMPORTANT BAUXITE OCCURRENCES IN THE CARIBBEAN REGION AND IN ITS SURROUNDINGS

(Compiled by L. KORPÁS 1988 on the basis of R. WEYL 1961, 1966, I. VALETON 1972, G. I. BUSHINSKIY 1975, E. ILKEY-PERLAKY 1978, GY. KOMLÓSSY—A. VÉGH 1980, J. E. CASE—T. L. HOLOCOMBE 1980, P. W. GUILD et al. 1981, GY. BÁRDOSSY 1982, GY. KOMLÓSSY 1987)



- ○ Carstbauxite deposits
- ● Lateritbauxite deposits

- △ Carstbauxite indications
- ▲ Lateritbauxite indications

TECTONIC UNITS

I. Northern craton
II. Northern continental margin
III. Northern accretionary neoplatform
IV. Cayman trench
V. Puerto Rico trench
VI. Quasiplatform
VII. Western accretionary neoplatform
VIII. Lesser Antilles island arc
IX. Southern accretionary neoplatform
X. Andean deformation belt
XI. Southern continental margin
XII. Southern craton

Plate boundaries
Convergent plate boundaries
Tectonic unit's boundaries

NAME AND GEOGRAPHIC POSITION OF THE BAUXITE OCCURRENCES

UNITED STATES

1. Arkansas
2. Tippah Benton
3. Pontotoc
4. Winston—Noxubee—Kemper
5. Margerum
6. Eufala
7. Springvale
8. Andersonwille
9. Irwinton
10. Warm Spring
11. Spottswood
12. Indian Mound
13. Elizabethtown
14. Chattanooga
15. Summerwille
16. Hermitage, Cave Springs, Bobo
17. Fort Payne
18. Congo
19. Rock Run, Goshen V.
20. Ashwille
21. Jacksonwille
22. Nances Creek
23. Anniston
24. De Armanwille
25. Talladega
26. Missouri

MEXICO

1. Ostvacan (Estacion Juarez)
2. Tenejapa
3. Monte Bello

CUBA

1. Sierra Azul–Pan de Guajaiban
2. Guantanamo North
3. Guantanamo East
4. Moa–Baracoa
5. Maisi
6. Manga Largo
7. Mantua
8. Tranquilidaa

JAMAICA

1. Saint–Ann
2. Cockpit country
3. Essex valley
4. Manchester
5. Clanderon
6. Saint Catherine

PUERTO RICO

1. Florida

HAITI

1. Massif de la Hotte
2. Miragoane
3. Rochelois

DOMINICA

1. Sierra de Bahoruco
2. Las Mercedes

BAHAMAS

1–2. Eleuthera
3. New Providence

CAYMAN ISLANDS

1. Grand Cayman

GUATEMALA

1. Alta Verapaz

COSTA RICA

1. San Isidro General
2. ?

PANAMA

1. David
2. Las Lajas
3. Tole
4. Las Palmas

COLUMBIA

1. Antiochia
2. Morales–Cajibio

VENEZUELA

1. Upata
2. Nuria
3. Gran Sabane
4. Los Guaicos
5. Pijiguaos

GUYANA

1. Pomeroon
2. Essequibo
3. Mackenzie
4. Ituni
5. Kwakwani
6. Canje
7. Blue Mountains
8. Pakaraima Mountains

SURINAME

1. Suriname River
2. Moengo, Rickanau
3. Nassau Mountains
4. Bakhuis
5. Brown Mountains
6. Lely Mountains
7. Wana Wiero Hills

FRENCH GUYANA

1. Roura
2. Kaw Mountains

GEOHISTORICAL AND STRUCTURAL INTERPRETATION OF SINGLE BAUXITE DEPOSITS FROM THE CIRCUM-CARIBBEAN REGION

An island arc area of intricate geology and structure, the Caribbean has had a geological and tectogenetic history in which the evolutionary stages discussed can be readi distinguished and reconstructed (Fig. 1, Profiles A—F). The geographic distribution an range of the associated bauxite occurrences and resource indications are illustrated i Fig. 2. The morphostructural positions of the particular typical bauxite deposits withi the evolutionary stages, their genetic types and age data are given in Table 1.

Regarding the stage of ancient continental rifting and the formation of an oceanic crusted basin (Late Triassic—Late Jurassic), the only so far known bauxite resource indication from the bauxite geologically favourable morphostructural units is located in th southern continental margin area. This is situated in western Cuba, being of karstic intraformational genetic type and Upper Jurassic (Callovian—Oxfordian) in age.

The bauxite geologically favourable morphostructural units of the oceanic vo canic arcs development stage (Late Jurassic—Late Eocene) include the northern craton and continental margin and the southern craton. Almost all dated bauxite deposi of the northern craton and continental margin are of karstic type. Out of these, th Sierra Azul-Pan de Guajaibon deposit in western Cuba is unique regarding both its ag (Albian— Cenomanian) and type (intraformational). The occurrences listed from th territory of the U.S.A. are of Upper Cretaceous—Paleogene, Upper Cretaceous—Lowe Eocene and Lower Eocene age. As a contrast, all the "older" Cretaceous—Paleogen deposits known from the southern craton area belong to the lateritic, lateritic–terrigenous genetic types. The bauxite deposits of South America assigned to this grou are of Upper Cretaceous (?), Paleocene—(Lower) Eocene and Eocene age.

The Central American part of the circum-Pacific subduction zone is interprete controversially enough, as an example of the active oceanic volcanic arc versus continent collision stage. It is the accretion neoplatform on the western margin of the Caribbean that has been rated as a bauxite geologically favourable morphostructural unit. Th bauxite deposits known from there (Costa Rica, Panama) are lateritic bauxites forme on young basalts, varying from Upper Miocene to Quaternary in age.

An active collision (subduction) of oceanic volcanic arcs is considered to hav been responsible for the bauxite deposits and resource indications known from th Greater Antilles. Regarding their morphostructural position, they belong, all, to th northern accretion neoplatform and the "quasiplatform" respectively. Genetically, the are for the most part of karstic type with a sporadical representation of the intrafor mational type, lateritic resource indications being quite subordinate and limited, as far a our present-day knowledge goes, to Cuba. The time of their formation spans the Uppe Oligocene—Quaternary interval. Within this time span, some intraformational resourc indications are of Upper Oligocene—Lower Miocene and Middle/Upper Miocene age.

A classic example of the passive collision (obduction) of oceanic volcanic arcs i provided by the collision front of the Cuban Island Arc and the Bahama platform (th Great Bahama Bank). Of the bauxite geologically positive morphostructural units tha have evolved here a Lower/Middle Miocene, karstic intraformational bauxite resourc indication is found in Central Cuba and Pliocene-Quaternary karstic bauxite resourc indications are known from the Bahamas.

CONCLUSION

The bauxite geological model has been developed on the basis of data from th relevant literature. I am aware of the fact that this model is a rather simplified an generalizing one. In spite of this I am convinced that it can be used for a concrete bauxit geological reconstruction of other island arc areas.

The applicability of the model has been illustrated by examples taken from th Caribbean. The conclusions thus derived are as follows:

— The known Caribbean bauxite deposits and resource indications are assignabl without any difficulty to the geohistorical stages of the model and to the associate morphostructural units. In the light of the foregoing, I believe, that the bauxite geological potentialities of the Caribbean are—at least from the viewpoint of geological—geo historical reconstructions—still far from being exhausted. Potential Late Mesozoi (Jurassic—Cretaceous) and Early Paleogene (Paleocene—Eocene) bauxite horizon may be of considerable importance in the Caribbean.

— What is believed to be important to emphasize is that bauxite geologica prospects cannot be assessed unless the work to that end is based on a concrete geohistorical reconstruction during which the evolutionary stages favouring bauxitization an bauxite accumulation should be determined and in this context the advantageous morphostructural units should be delineated.

— Examples from the Caribbean alone have enabled me to conclude that th bauxite deposits of island arcs belong mainly to the karstic, subordinately to the lateriti genetic type. This is in harmony primarily with the opinion universally adopted in th Soviet literature and confirmed by GY. BÁRDOSSY (1981, p. 316) that the bauxite occurrences in orogenic (=eugeosynclinal) zones are genetically overwhelmingly of karsti type.

— Let us point out that while interpreting island arc areas bauxite genetically it i not sufficient for one to restrict oneself to reconstruct the island arc in a strict sense, but that one must bear in mind the necessity for taking into consideration the continental margins concomitant of the island arcs and their active and passive collision zones as well.

BIBLIOGRAPHY

ALEVA G. J. J. 1965: The buried bauxite deposits of Onwerdacht, Surinam, South America. — Geologie en Mijnbouw. 44.: 44—58.

— 1981a: Essential differences between the bauxite deposits along the Southern edges of the Guiana shield, South America. — Economic Geology. 76. (5): 1142—1152.

— 1981b: Bauxitic and other duricrusts on the Guiana shield, South America. In Lateritisation Processes, Proceedings of the International Seminar on Lateritisation Processes. — : 261—269.

BÁRDOSSY GY. 1973: Bauxitképzódés és lemeztektonika. — MTA X. Oszt. Közl. 6. (1—4): 227—240.

— 1977: Karsztbauxitok. — Akad. Kiadó, Budapest.

— 1979: The role of tectonism in the formation of bauxite deposits. — Travaux.: 15—34.

— 1981: Karst Bauxites. — Mir, Moscow.

— 1982: Karst bauxites. Bauxite deposits on carbonate rocks. — Akad. Kiadó, Budapest.

BIJOU DUVAL B.—BIZON G.—MASCLE A.—MULLER C. 1983: Active margin processes: Field observations in Southern Hispanola. In WATKINS J. S.—DRAKE C. L. (edit.) Studies in continental margin geology. — American Association of Petroleum Geologists. Memoir 34.: 325—344.

BURKE C. A.—DRAKE C. L. (edit). 1974: The geology of continental margins. — Springer Verlag, Berlin—Heidelberg—New York.

BUSHINSKIY G. I. 1971: Bauxite Geology. — Nedra, Moscow.

— 1975: Bauxite Geology. — Nedra, Moscow.

CASE J. E.—HOLOCOMBE T. L. 1980: Geologic-tectonic map of the Caribbean region, scale 1:2 500 000. — Department of the Interior. United States Geological Survey, Miscellaneous Investigations Series. Map I—1100.

CASE J. E.—HOLOCOMBE T. L.—MARTIN R. G. 1984: Map of geologic provinces in the Caribbean region. — Geological Society of America, Memoir (162): 1—30.

COLEMAN R. G.—IRWIN W. P. 1974: Ophiolites and ancient continental margins. In BURKE C. A.—DRAKE C. L. (edit.) 1974: The geology of continental margins.: 921—931. — Springer Verlag, Berlin—Heidelberg—New York.

DICKINSON W. R. 1973: Widths of moderns arc-trench gaps proportional to past duration of igneous activity in associated magmatic arcs. — Jour. Geophys. Research. 78.: 3376—3389.

— 1974: Sedimentation within and beside ancient and modern magmatic arcs In DOTT R. H. Jr.—SHAVER R. H. (edit.) Modern and ancient geosynclinal sedimentation. — Society of economic paleontogists and mineralogists. Special Publications. 19.: 230—239.

— 1976: Sedimentary basins developed during evolution of Mesozoic—Cenozoic arc-trench system in Western North America. — Canadian Jour. Earth Sci. 13.: 1268—1287.

DICKINSON W. R.—SEELY D. R. 1979: Structure and stratigraphy of forearc regions. — American Association of Petroleum Geologists, Bulletin. 63. (1): 2—31.

DOTT R. H. Jr.—SHAVER R. H. (edit.) 1974: Modern and ancient geosynclinal sedimentation. — Soci of economic paleontologists and mineralogists, Special Publication.: 19.: Tulsa, Oklahoma, U

ERNST W. G. 1974: Metamorphism and ancient continental margins. In BURKE C. A.—DRAKE C. (edit.) The geology of continental margins. :907—919. — Springer Verlag, Berlin—Heid berg—New York.

GUILD P. W.—MCCARTNEY W. D.—LEECH G. B.—DENGO G.—ELLITSGAARD RASMUSSEN K SALAS G. P.—GONZALEZ REYNA J. 1981: Preliminary metallogenic map of No America. Scale 1:5 000 000. — Interior Geological Survey, Reston, VA. G. 79199.

HALL D. J.—CAVANAUGH D.—WATKINS J. S.—MCMILLEN K. J. 1983: The rotational origin the Gulf of Mexico based on regional gravity date. In WATKINS J. S.—DRAKE C. L. (ed Studies in continental margin geology. — American Association of Petroleum Geologists. Mem 34.: 115—126.

HAMILTON W. 1977: Subduction in the Indonesian region. In Island arcs, deep sea trenches and basi — Amer. Geophys. Union, Maurice Ewing. Ser. 1.: 15—32.

HSÜ K. J. 1974: Melanges and their distinction from olistotromes. In DOTT R. H. Jr.—SHAVER R. (edit.) Modern and ancient geosynclinal sedimentation. — Society of economic paleontologi and mineralogists. Special Publications 19.: 321—333. Tulsa, Oklahoma, USA.

ILKEYNÉ PERLAKI E. 1978: A Karib-tengeri szigetek földtana, bauxittelepei és bauxitképződési lehe ségei. (Előtanulmány a N. G. K. B. piackutató program tevékenységéhez). — Magyar Álla Földtani Intézet, Adattár (manuscript).

KARIG D. E. 1970: Ridges and basins of the Tonga-Kermadec island arc system. — Journ. Geoph Research. 75.: 239—254.

— 1972: Remnant arcs. — Geological Society of America, Bulletin. 83.: 1057—1068.

— 1974: Evolution of arc system in the Western Pacific. — Am. Res. Earth and Planetary S 2.: 51—75.

KARIG D. E.—SHARMAN G. F. III 1975: Subduction and accretion in trenches. — Geological Soci of America, Bulletin. 86.: 337—389.

KIRPAL' G. R. 1980: Prognostic and Prospection of bauxite deposits. — Nedra, Moscow.

KOMLÓSSY GY. 1987: Study of Ostuacan bauxite deposits. — UNIDO, Vienna (manuscript).

KOMLÓSSY GY.—VÉGH A. 1980: Karib tengeri térség. II. Venezuela, Guyana, Suriname és Fran Guyana bauxitföldtani viszonyai. (N. G. K. B. piackutató előtanulmány). — Magyar Álla Földtani Intézet, Adattár (manuscript).

KORPÁS L. 1988: Az óceáni trópusi szigetívek bauxitprognózisának földtani—módszertani alapjai Ku példáján. — Földtani Kutatás, 31. (3—4):1—74.

L. KORPÁS—N. PONCE SEOANE—D. RAZUMOVSKIY 1986: Bauxitiferous epochs in Cuba and th comparison with the bauxitiferous horizons of the Caribbean and its surroundings. — 11 Caribbean Geological Conference, Barbados Abstracts, :53—54.

LU R. S.—MCMILLEN K. J. 1983: Multichannel seismic survey of the Colombia basin and adjac margins. In WATKINS J. S.—DRAKE C. L. (edit.) Studies in continental margin geology. Association of American Petroleum Geologists. Memoir 34.: 395—410.

LUDWIG W. J.—EWING J. I.—EWING M.—MURAVCHI S.—PEN N.—ASANO S.—HOTTA H. HAYAKAWA M.—ASANUMA T.—ICHIKAWA T.—NOGUCHI I. 1966: Sediments and stru ture of the Japan trench. — Journ. of Geophys. Research. 71.: 2121—2137.

MARLOW M. S.—SCHOLL D. W.—BUFFINGTON E. C.—ALPHA T. R. 1973: Tectonic history the Central Aleutian arc. — Geological Society of America, Bulletin. 84.: 1555—1574.

MIKHAJLOV V. M. et al. 1973: Explanations to the bauxitprognostic map of USSR. Scale 1:5 000 0 — MGFGI. Leningrad.

MITCHELL A. H.—READING H. G. 1971: Evolution of island arcs. — Journ. of Geology. 79. (253—284.

MOORE G. F.—KARIG D. E. 1976: Development of sedimentary basins of the lower trench slope. — Geology. 4.: 693—697.

NAIRN A. E. M.—STEHLI F. G. (edit.) 1974, 1975: 1. The ocean basins and margins. 2. The Nort Atlantic. 3. The Gulf of Mexico and the Caribbean. — New York—London.

National Academy of Sciences 1979: Continental margins, geological and geophysical research nee and problems. — Ocean Sciences Board, Assemble of Mathematical and Physical Science National Research Council. Washington, D. C.

PEYVE A. V. 1947: Tectonics of the North Uralian Bauxite Belt. — Bulletin of MARN, Moscow, Department of Geology. 4. (8):207.

N. PONCE—L. KORPÁS—O. RAZUMOVSKIY 1985: The bauxite perspectives of the Cuban Neogen — VIIIth Congress of the Regional Committee on Mediterranean Neogene Stratigraphy, Abstracts,: 476. Hungarian Geological Survey, Budapest.

O. O. RAZUMOVSKIY—N. PONCE—L. N. DANILIUK—M. DILLA—L. KORPÁS 1987: Diaspore bauxites of West Cuba. — Lithology and Raw Materials, 5.:27—35.

O. O. RAZUMOVSKIY—N. PONCE—L. KORPÁS 1986: Bauxite prognostic map of the Republic o Cuba, scale 1500 000. — Weathering crusts as sources for complex Raw Materials, Abstract of Federal Meeting, 1986 Magnitogorsk, edited in Chelyabinsk, :60.

RINGWOOD A. E. 1974: The petrological evolution of island arc systems. — Journ. Geol. Soc. 130 183—204.

SEELY D. R. 1977: The significance of landward vergence and oblique structural trends on trench inne slopes. In Island arcs, deep sea trenches and back-arc basins. — Am. Geophys. Union; Maurice Ewing. 1.: 187—198.

— 1979: The evolution of structural highs bordering major forearc basins. In WATKINS J. S.—MONTADERT L.—DICKERSON P. W. (edit.) Geological and geophysical investigations o continental margins. — American Association of Petroleum Geologists. Memoir 29.: 245—260

SEELY D. R.—VAIL P. R.—WALTON G. G. 1974: Trench slope model. In BURKE C. A.—DRAK C. L. (edit.) The geology of continental margins. :249—260. — Springer Verlag, Berlin—Heidelberg—New York.

TALWANI M.—PITMAN W. C. (edit.) 1977: Island arcs, deep sea trenches and back-arc basins. — Am. Geophys. Union. Maurice Ewing. 1.

VALETON I. 1972: Bauxites. — Elsevier, Amsterdam—London—New York.

WATKINS J. S.—MONTADERT L.—DICKERSON P. W. (edit.) 1979: Geological and geophysical investigations of continental margins. — American Association of Petroleum Geologists. Memoi 29.: 245—260.

WATKINS J. S.—DRAKE C. L. (edit.) 1983: Studies in continental margin geology. — American Association of Petroleum Geologists. Memoir 34.: 325—344.

WEYL R. 1961: Die Geologie Mittelamerikas. — Gebrüder Borntraeger, Berlin.

— 1966: Geologie der Antillen. — Gebrüder Borntraeger, Berlin.

CONTENTS

HU ISBN 963 671 131 3

Kiadja a Magyar Állami Földtani Intézet
Felelős kiadó: DR. HÁMOR GÉZA igazgató
Készült a Magyar Állami Földtani Intézet nyomdájában
Terjedelem: 1,8 (A/5) ív. Példányszám: 1000. Engedélyszám: 16072/89.
Felelős vezető: Münnich Dénes