

## **TECTONIC CONTROL OF MESOZOIC MAFIC AND ALKALINE BODIES IN THE AMAZON CRATON (BRAZIL)**

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The Amazon Craton underwent significant tectonomagmatic activity during Mesozoic time, marked by dykes swarms, sills, laccoliths, and flows of mafic volcanics and stocks of alkaline bodies. This event affected the entire South American Platform and is essentially related to tectonic processes which resulted in the formation of the Atlantic Ocean.

A geotectonic scheme of the Amazon Craton (Brazilian portion), based on LIMA (1984) is presented in Figure 1 and shows the mafic dikes and alkaline magmatic activities of Mesozoic age.

The Amazon Craton is a Brasiliano (Pan-African) entity, having been consolidated during the previous, Middle Proterozoic Uruçuano Cycle. Truly Archean nuclei crop out in southern Pará (Pau-d'Arco Nucleus) and northern Amapá (Oiapoque Nucleus). These terrains in the eastern Amazon region of Brazil were reworked during the Transamazonian Cycle due to the evolution of the Maroni-Itacaiúnas (2,250-1,950 Ma) and Central Guyana (1,950-1,900 Ma) mobile belts, with NW-SE and NE-SW to ENE-WSW trends, respectively. Associated with these belts are shear zones with ultramylonites, mylonites, pseudotachylites, breccias and cataclasites, for example, the Itacaiúnas (ZBI), Tumucumaque (ZBT), Mucajá (ZBM), Anauá (ZBA), and Parima (ZBP) shear zones.

About 1,750-1,600 Ma ago the craton was affected by the evolution of the NW-SE oriented Rio Negro-Juruena mobile belt with continental subduction and collision. This was followed 1,500-1,400 Ma ago (Uruçuano Cycle) by development of the Rondoniano mobile belt and associated NW-SE oriented Jamari shear zone (ZBJ). Both of these geodynamic events were accompanied by

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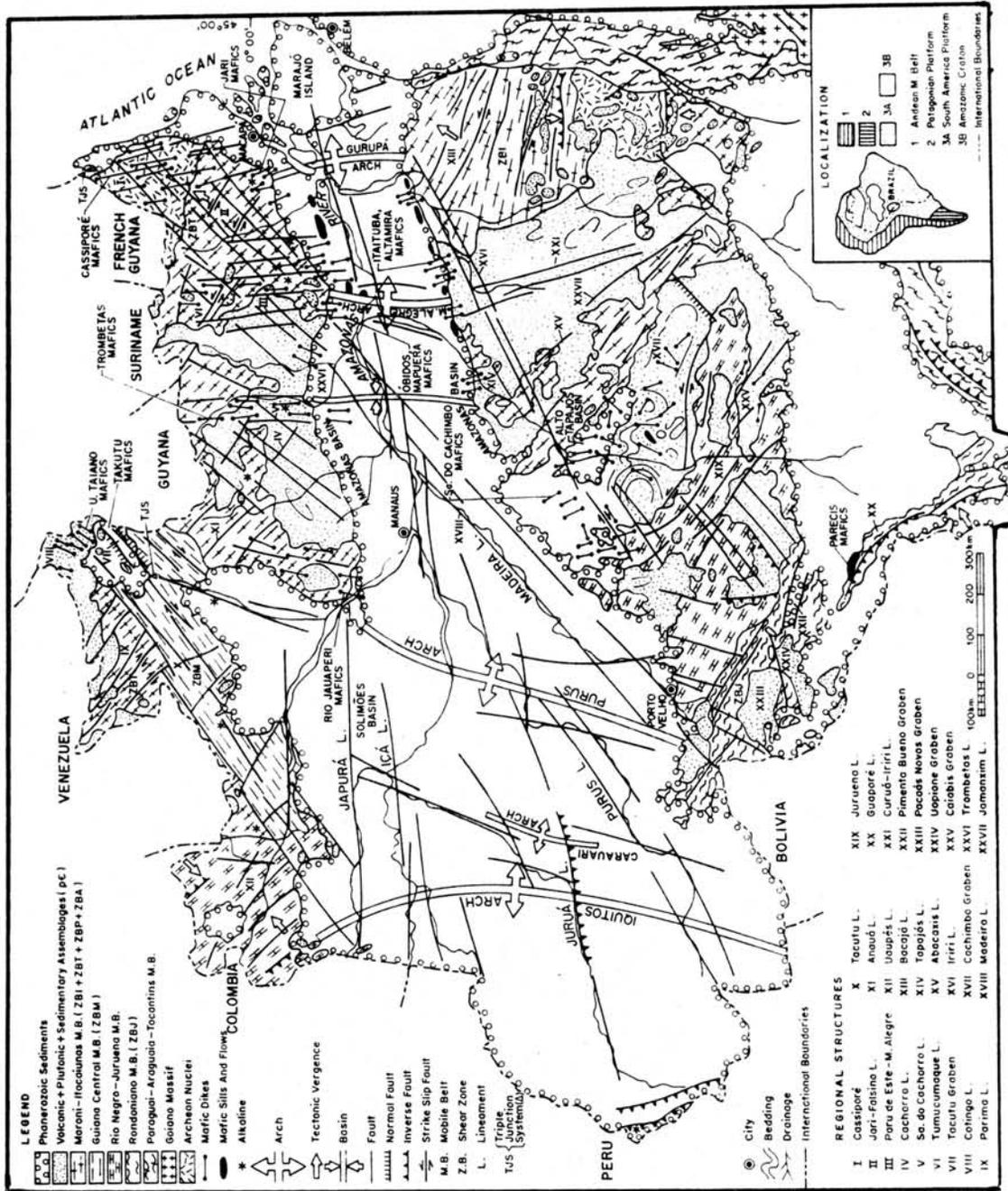


Figure 1 - Amazon Craton (Brazil). Mesozoic mafic and alkaline bodies and their relationships with geotectonic units. Modified from LIMA (1984).

intensive and extensive acid to intermediate volcano-plutonic and basic plutonic activity. Basic volcanism occurred as well together with sedimentation of platform covers on the "quasi-craton". This diverse magmatism may be interpreted as having been associated with deep geosutures originating at the lithosphere-asthenosphere interface.

The observed east to west migration of Precambrian crustal magmatism within the Amazon Craton is represented by the Akawaian, Parguazan, and Costa Marques episodes of the Atroaris Igneous Cycle. These episodes were accompanied by platform reactivation with block faulting and isomorphous folding throughout the sedimentary covers of the craton, designated as the K'mudku, Krokraimoro, Cachimbo, Trafa and Aguapé events. At the beginning of the Paleozoic, the Amazonas and Solimões basins formed due to the development of dextral faults and the Romanche fracture, accompanied by rotational movements in the Amazon Craton.

OLIVEIRA & MONTES (1984) named the main Mesozoic mafic dike swarms in the Amazon Craton as follows: Serra do Cachimbo (SCM), Cassiporé (CM), Jari (JM), Ébidos - Mapuera (OMM), Itaituba-Altamira (IAM), Taiano-Uraricoera (TUM), Takutu River (TCM), and Trombetas River mafics (TM). In the present study, the denomination of the Parecis mafics (SPM) and Jauaperi River mafics (JPM) are adopted for occurrences in the southern Amazon and north of Manaus, respectively. Table 1 shows the main characteristics of the Mesozoic mafic bodies. The most common lithologies are: diabase (d), basalt (b) and gabbro (g). Body types include dikes (dk), sills (sl), flows (fl), and laccoliths (lc).

The main alkaline Mesozoic bodies in the Amazon Craton are the Maecuru (MEA), Maracón (MRA), Camaípi (CA), Catrimani (CTA), and Seis Lagos (SLA) bodies. Of these, CTA is the only one which has been radiometrically dated (100 Ma), although all the others are also interpreted as Mesozoic. Table 2 shows the main characteristics of these alkaline bodies, which vary in composition from intermediate (Interm.) and carbonatitic (Carb.) to mafic.

Additional alkaline bodies in the Takutu and Rio Trombetas Lineaments have also been plotted in Figure 1, based on photointerpretation of RADAR images.

The mafic bodies of Cassiporé (CM), north of Macapá, are parallel to the Atlantic coast and trend N-S, comprising the Cassiporé Lineament which is associated with a set of NE-SW fractures (Jari-Falsino Lineament). Such structures are related to reactivation of the Gurupá Arch and are considered to have been associated with pre-drift processes. The authors consider the Olapoque River structure, oriented NE-SW, nor show in Figure 1, at the boundary of French Guiana and Brazil, as representing a possible triple junction system, due to its linear trend for hundreds, of kilometers, in association with the great abundance of mafic dikes (CM) adjacent to the coast. The Jari mafic bodies

Table 1 - Mesozoic mafic bodies. See text for abbreviations.

Mafic group	Radiometric Method	Age (Ga)	Lithol.	Trend	Length (km)	Body Type
CM	K-Ar	0.16-0.25	d	N;NNE	400	dk
JM	-	-	d	N;NE	200	dk
OMM	K-Ar	0.13-0.18	d;g	N;NE;NW	300	dk;sl;lc
IAM	K-Ar	0.13-0.18	d;g	N;NNE	50	dk;sl
JPM	-	-	d;g	NNE	250	dk
TM	K-Ar	0.20	d	N;NNE	500	dk
TCM	K-Ar	0.15-0.18	b;d	NE	100	dk;fl
TUM	K-Ar	0.13-0.15	d	N;NE	100	dk
SPM	K-Ar	0.11-0.15	b;d	NE;NW	50	fl;dk;sl
SCM	K-Ar	0.18-0.22	d	NE;NW;N	400	dk;fl;lc

Table 2 - Mesozoic alkaline bodies. See text for abbreviations.

Alkaline Body	Radiometric method	Age (Ga)	Composition	Regional structure
MEA	-	-	Mafic	M.Alegre Arch
MRA	-	-	Mafic	M.Alegre Arch
CA	-	-	Mafic	Gurupá Arch
CTA	Rb-Sr	0.10	Interm.	Takutu Lineament
SLA	-	-	Carb.	Takutu Lineament

(JM) constitute a continuation of the Cassiporé mafics, so they may also be related to the reactivation of the Gurupá Arch.

BARROS et al. (1983) reported the occurrence of an alkaline mafic intrusion, about 1,200 m in diameter and 80 m high, in the Camaipi river basin, composed of malignite, essexite and nepheline-aegerine monzodiorite rich in ilmenite. Despite the characteristic absence of magnetite in this occurrence magnetometric maps of the Jari-Rio Negro Leste Project of the DNPM indicate a local magnetic anomaly. The Êbidos-Mapuera (CAM) and Itaituba-Altamira (IAM) mafics are related to reactivation of the Monte Alegre Arch. They are exposed in both sides of the middle Amazonas basin as dikes, sills and laccoliths. Likewise, the Maicuru (MEA) and Maraconai (MRA) alkalines appear to be related to the Monte Alegre Arch. Towards the south of the Craton, in the Central Brazilian Shield, Mesozoic alkaline occurrences have not been identified.

The Rio Trombetas mafics (TM) are associated with the N-S Trombetas Lineament, which may coincide with the possible structural division of the lower and middle portions of the Amazonas Basin. At the northern extremity of this structural trend, the Mutum alkaline complex is found, although its age is Precambrian (a case of reactivated Precambrian structure?). The Taiano-Uraricoera (TUM) and Takutu (TCM) mafics are associated with the Boa Vista Arch, which may be connected with the evolution of the Takutu Graben. They include the basaltic Apoteri Formation and associated Catrimani and Seis Lagos alkaline bodies.

On the whole, the Mesozoic magmatic event occurred preferentially in the Central Guyana Mobile Belt. Many authors have commented on the possible existence of a triple junction system in this region. According to this hypothesis, one of the branches of the system would coincide with the Branco river and the other with the Takutu Graben.

The Jauaperi River mafics (JPM) seem to be related to reactivation of the Purus Arch, which is more evident in the Guyana Shield than in the Central Brazilian Shield.

The Serra do Cachimbo mafics (SCM) are located in the Cachimbo range and also in the Caiabis range. They seem to be related to reactivation of the Juruena Arch (Juruena Lineament). The Parecis mafics (SPM) seem to be related to the Guaporé Lineament in southernmost Amazon Craton.

The great importance of the Mesozoic reactivation in the Amazon Craton is also corroborated by the development of the Juruá Transcurrent fault (Juruá Lineament) and associated faults of Cretaceous age, of great significance for petroleum geology. It is probable that such transcurrent structures are associated with the Takutu Graben (Takutu Event).

In conclusion, structural control of Mesozoic mafic and alkaline bodies by

reactivated arch structures or by Precambrian relict structures is suggested. In addition, Mesozoic reactivation in Amazon Craton developed from east to west, as suggested by decreasing radiometric ages of these mafic and alkaline rocks. There are still big gaps in the knowledge of alkaline rocks, but overall it may be suggested that the most propitious sites for their emplacement would be the Gurupá, Monte Alegre and Purus Arches, as well as the Tukutu Lineament, among others. Around the Acre Basin and Moa Range (southern Amazon region), there also occur alkaline rocks (e.g., República Syenite), although their radiometric ages are not well defined. Finally, in Peru, southeast of the Moa Range, there is another alkaline intrusion of probable Mesozoic age.

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