A Study of the Primary Granitoid Outcroppings and Sedimentary Rocks in the Boali Region of the Central African Republic

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Abstract

Located in the Central African Republic, the region of Boali is noted for its waterfalls and for the nearby hydroelectric projects. The waterfalls of Boali are 250 m wide and 50 m high, and are a popular tourist destination. The Central African Republic (CAR) has large reserves of Granitoids that remain largely untapped. That is why these rocks, which outcrop and which constitute the base of the Boali region and its surroundings, caught our attention. Previous studies by Bowen (1915) explained the order of appearance of various minerals as a function of the temperature and initial magma (SiO_2) content. According to Bowen's diagram, we can say that the magma underwent a magmatic differentiation giving rocks that are poor in silica (Diorite), followed by rocks rich in silica (Granodiorite and Granite). Knowing the absolute age of the Granitoids on the edge of the craton of Mbomou (2.1 Ga, Moloto *et al*., 2008, and Toteu *et al*, 1994), we can deduce the chronology of other formations. Initially there was the formation of the metamorphic formations and sandstones of Boali. This was followed by a slow intrusion of magma which crystallized in depth to give grainy rock (granitoids and pegmatite) in the region of Boali. This intrusion had metamorphosed the pre-existing formations through an orthogneiss.

Introduction

BOALI IS A TOWN located in the Ombella M'poko prefecture of the Central African Republic (CAR) (See Figure 1). It is located 100 km northwest of Bangui, the capital of CAR. Boali is between 18°7′0″E longitude, and 4°48′0″N latitude. Access is through the National Road 1 (RN1).

Boali is a sub-prefecture in the CAR. The CAR is divided into 16 administrative prefectures, two of which are economic prefectures, and one an autonomous commune; the prefectures are further divided into 71 sub-prefectures. The prefectures are Bamingui-Bangoran, Basse-Kotto, Haute-Kotto, Haut-Mbomou, Kémo, Lobaye, Mambéré-Kadéï, Mbomou, Nana-

Mambéré, Ombella-M'Poko, Ouaka, Ouham, Ouham-Pendé and Vakaga. The economic prefectures are Nana-Grébizi and Sangha-Mbaéré, while the commune is the capital city of Bangui.

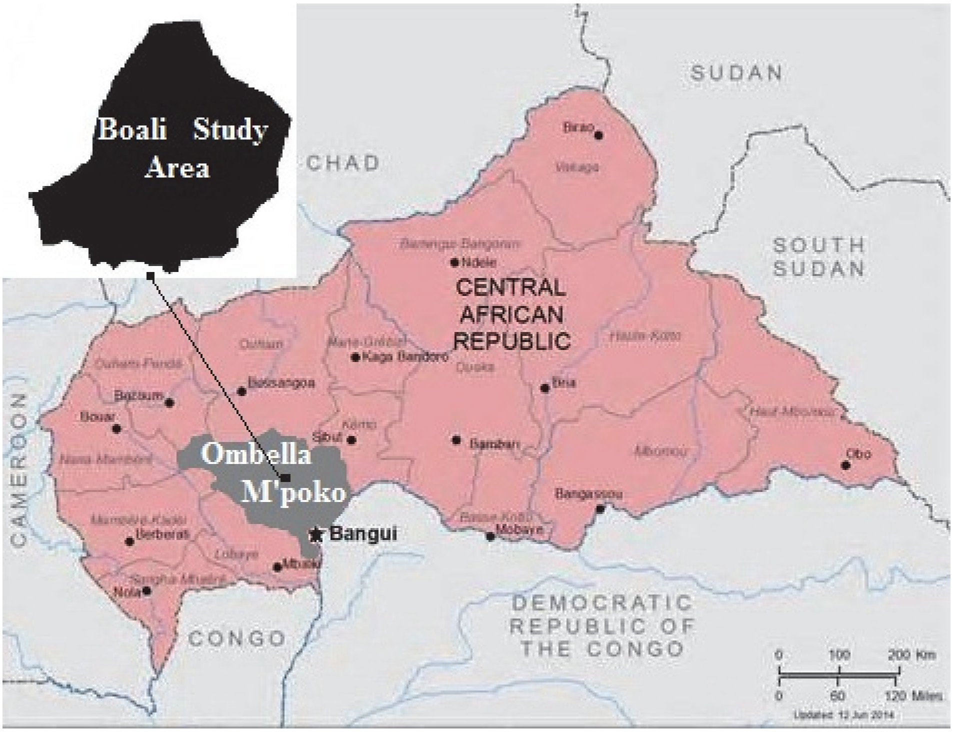

Fig. 1: Map of CAR showing Ombella M'poko and Boali study area

The Central African Republic is a country rich in mineral resources with an important reserve of Granitoids. Granitoid or granitic rock is a variety of coarse grained plutonic rock similar to granite which is composed predominantly of feldspar and quartz. These rocks outcropped and constitute the base of the Boali region, but unfortunately are not exploited.

Geologically Boali is very interesting because of its Granitoids. We will identify and define the importance and usefulness of the Granitoids not only to geology, but also for the economy and social development in the CAR. We note that a school was built at Crossing-Boali in 1953 by the priest Alosiste Gezst, and recently, in 2001, the College of General Education (C.G.E) was built.

Early geologic studies by Bowen (1915) defined the order of appearance of various minerals. Cornacchia *et al*. (1989) described the geologic formations of Boali. They mentioned that the greenstone belt of Bogoin-Boali rocks represents a succession of structures with a narrow synclinal appearance drawing a large half circle. These structures end in the east in the Bogoin area and to the north in the Boali sector as the outcroppings observed north of Boali.

Poidevin (1979) defined the geochemistry of Precambrian basaltic rocks from the CAR; at Mbi not far from the river M'poko there are three types of petrographs: Schist sericitic, chlorite schist, and quartzite. Cornacchia and Dars (1983) showed that a corridor of faults cut north of the CAR existed. Cornacchia *et al.* (1985) found in the sandstone quartz veins containing crystals of rocks. Poidevin and Pin (1986) showed that the outcropping is plural-kilometric with an intrusion of dolerite and granites.

Lithological studies of the Boali-Bogoin-Mbi region by Cornacchia and Giorgi (1986) defined a vast area ranging from the border of the republic of the Congo to south of the Lobaye Subit-Possel road including the Boda area. Their work was carried out south of the M'poko River and continued from the town of Bogoin to Yangana up to the Yasi series in the area of Bangui.

Biandja (1988) carried out his work largely in the northern region of the Bogoin. Biandja (2000) pointed out that the southern part of the Boali region is characterized by a series of "Mbi" (waterfalls) incorporated from the bottom upwards. The series contains amphibolites of Mbali and Mbi and pillow basalts. All the intruded granite is in the lower course of the river Mandjo. North of the Bako village on the Mbi, this succession of granite becomes abnormal when it contacts the red sandstone and the red shale of the base of the sandstone shale set. In the northern region of the Bogoin there is a succession of chloritized migmatite and amphibolites that include some biotite in the faults area. There is also migmatized ferruginous quartzite. The sub-horizontal schistose sandstone does not conform to the christallophylliennes formations. However, the whole region of Boali does show some similarities between the north and south.

According to studies done by Poidevin (1991), Biandja (1988); and Cornacchia *et al*. (1985-1989), the Boali region forms the southern part of a greenstone belt that represents the northwestern part of Bogoin-Boali. The orientation of this greenstone belt runs east-west ending at the eastern edge and marries with an intrusive granite border at the western edge. According to the report from the meteorological station of Mbali covering 1993 to 2000, the average annual rainfall generally ranges from 1900 mm in February to 2630 mm in December, with an average maximum of 2868 mm. The Granitoids are on the edge of the craton of Mbomou (age 2.1 Ga) (Moloto *et al*., 2008; Toteu *et al,* 1994). A craton is a large, stable block of the Earth's crust forming the nucleus of a continent. Recent studies by Rolin (1992) focused in the Central African Republic area of pan-African strike-slip of the Oubanguides. In general, Djebebe-Ndjiguim (2013) found that the density of the vegetation made it very difficult to search for significant outcrops.

We continue their work to include not only new information on the geologic formation of the Boali region, but also to note the effect that non-exploitation of the granitoids in the area has on the region. It is a complex issue. Consequently the granitoids have not contributed to the social development in the Boali area in particular and to the CAR in general.

Techniques Used to Gather the Data

Boali is located 100 km northwest of Bangui, the capital of CAR. This field study was done on 24/25 June 2015. We used the basic tools of the geologist: a compass, camera, hammer, bag, notebook, and pencil. Our general approach is based on the work of Cornacchia and Giorgi (1986). As noted by Djebebe-Ndjiguim (2013) the amount and density of the vegetation made it very difficult to search for significant outcrops. The authors followed two protocols set by previous researchers.

The first protocol we followed was that of Biandja (1988). His work was carried out largely in the Bogoin northern region. In his lithological description he was able to list petrographic features consisting of lateritic, ferruginous, and conglomeratic blocks for recent formations. They contained, on average, quartzite, white quartzite, sandstone quartzite for covering the proterozoic formation; meta-volcano sedimentary, ferruginous quartzite, gneiss, Amphibolites, meta-volcanic basic to ultra-basic schist, and Metarhyolitoids (meta-volcanic acid) for the base formations of metamorphic rocks. For the intrusions Biandja distinguished many characteristics of crystalline Granitoid intruding porphyroides granites from the base.

The second protocol we followed was that of Poidevin (1991). His work was also carried out north of Bogoin. He identified different petrographic characteristics and classified them by stratigraphic unit (as U*n* where *n* is a number 1 to 4). His four classifications are: Andesite in pillow-lavas and chlorite amphibolites for the main basalt unit (U1); Para amphibolites, meta-rhyolites, with greywacke, feldspathic quartzite to amphiboles for the intermediate unit (U2); the greenstone and many pillow-lavas for the upper unit (U3); and Itabirite (U4). In addition to his four stratigraphic units, he also revealed the existence of geological formations of regional importance such as the granitoids and the series of schisto-quartzitic rocks.

The Geologic Data

We studied a variety of rocks types: plutonic; sedimentary; metamorphic; and deformations of rocks. In general, the extent and density of the local vegetation made it very difficult to search for significant outcroppings. (Djebebe-Ndjiguim 2013). We will consider the variety of rocks type by type.

Plutonic rocks

A pluton is a body of intrusive igneous rock (called *plutonic rock*) that is crystallized from magma slowly cooling below the surface of the Earth. In this category we studied two types: quartz veins and Granitoids.

Quartz vein (lode): There are two types of quartz veins in the study sector: metamorphic formations; and rock crystal veins located in the sandstone. Quartz veins are not barren of mineralized rock crystals. And so in these veins we noted the presence of some minerals, such as emerald and gold, due to the movement of warm waters (Cornacchia *et al*. 1985).

In the greenstone belt toward the vein wall there are altered Amphibolites in the chlorite-schist. According to Cornacchia *et al.* (1985), quartz veins containing rock crystals are found in the sandstone. These veins continue through to the quartz veins found in the metamorphic rocks. They originate in the emanation from granite and are mineralized rock crystal. The veins occur from 30° N to the south with a thickness of 15 centimeters to 5 meters and orient North 90° to 105°. They include some geodes in which beautiful quartz crystals have developed. The crystals have a thickness of at least 30 millimeters. They can reach 1.5 m thick in some geodes. Across the rock outcroppings in the direction N 30° they form solid blocks of milky-white appearance and are poly fractured.

During our field observations we spotted four levels of implementation veins in the quartz downstream of the dam at the Mbi, and even more implementation veins next to the road to Bossemmbele. These are the extension of those downstream of the dam. The seams are flush to both sides of the hill overlooking the dam. Some veins fold into a semicircle under the mast of the town's police station and also in the stone quarry.

Granitoids: Granitoids are plutonic rocks that are poor in silicon dioxide (SiO_2). They are designated in the upper part of the table of the international classification of streckeizen. In our region of Boali there are diorites, granodiorites, granites of Mbi, and granites of Bolen. We observed that granitoid outcroppings in the region cover a very large area. Although grey in appearance these rocks sometimes have alternating beds of dark ferromagnesian amphibole and biotite and clear beds (quartz, feldspar, and muscovite).

The granitoids of Mbi orient 30° N dipping 70° W. They are traversed by quartz aplite and pegmatite veins. These formations are subdivided into granite, matching granite, and orthogneiss.

Granite of Mbi - Granite is a fully crystalline rock. Minerals are on average 2 to 5 mm in size about the size of a grain of wheat (granite comes from the Latin granum = grain). They contain three essential minerals: quartz, alkali feldspar (orthoclase and microcline), and plagioclase combined with mica (biotite and muscovite). The quartz comes in a grayish color surrounding other crystals. Its appearance is that of salt but with a bold loamy appearance as if it burst out of the rock. In the region of Mbi the quartz has a conchoidal fracture. The alkali feldspars have variable colors (white, pink, red) and are twin Karlsbad (the crystal is alternately brilliant and dull). Biotite occurs in black strips some with a golden luster, with cleavages or cleavage lines. This intrusive massif has lagged behind the plate tectonics. It is late granite, very marked, and located on the left bank of Mbali in our study area. This massif has a grainy central facies with large elements of alkaline feldspar, very rich in feldspar, and with very fine grain borders. It manifests itself in the landscape by significant outcroppings and can be observed in the stone quarry without major difficulty.

Granodiorites: Granodiorites have a constitution nearly that of granite; their silica content can be as strong as that in granite but contains more plagioclase feldspar than orthoclase feldspar. Common rock "granite" can be distinguished from granodiorites by carefully considering their feldspar. Granodiorites of the Boali region have micro-fractures that allow the circulation of fluids. There is a possibility of finding gold and pyrite. The presence of the epidote gives the rock its green color. This epidotisation is due to the alteration of the potassium in the feldspar. The outcropping is plural-kilometric with an intrusion of the dolerite and granites. They are dated to 2.1 Ga. (Poidevin and Pin 1986)

Diorites: Diorite is an intrusive igneous grainy rock with a silica deficiency (less than 20%); therefore, it does not contain free quartz. It is principally composed of the minerals plagioclase feldspar (typically andesine), biotite, hornblende, and/or pyroxene. Feldspar, generally grayish, helps to give the rock a dark color. Diorites are intruding amphibolites and are contiguous with the granodiorites of Mbi.

Dolerite: Dolerites are intermediate rocks that fall between grainy gabbros and basalts with microlitic grain that is visible under a microscope and shows sub-hedral plagioclase laths molded by interstitial pyroxene. They are generally massive and compact with a color ranging from black to grey but more often dark green. We saw three hills of dolerite in the intruding granodiorites in a nearby outcropping of granite.

Contact areas: The Bangui-Boali section shows several contact areas characterized by vein crates between sedimentary rocks and metamorphic rocks. About 100 km from the first dam to the north of Boali we find a contact between Amphibolites and sandstones. The contact is characterized by a puckered quartz hill. At 123 km another contact is characterized by a type of vein that is favored by the hydrothermalism between granitoids and massive Amphibolites; there is another contact with upright schistosity (sub-vertical N 60°).

Sedimentary rocks

Sedimentary rocks are rocks that are formed by the deposition of material at the Earth's surface and within bodies of water. Sedimentation is the collective name for processes that cause mineral and/or organic particles (detritus) to settle and accumulate or minerals to precipitate from a solution. Sandstone is a sedimentary rock. It is a consolidated rock that belongs to the class of arenite rocks that have a grain size between 0.0625 and 1 mm.

Thus we can distinguish between quartz sandstones, where a microcrystalline material persists between the grains of quartz, and quartzite sandstone, where grains are linked to each other following a secondary pathway that depends on the cement. They are located south of the Kassango area and belong to the Oolitic sandstone of the Boali series (see Photo 1C which shows the sandstones of Boali falls). The corresponding features are homogeneous fine-grained quartzose sandstones (with clay cement in the south-west that changes to siliceous cement to the south and south-east). Quartzite occurs on the road to the city in the stratigraphic extension falls downstream from the third Boali falls. The sandstones are grayish and friable rocks whose diamante detrital minerals are amorphous quartz grains often recrystallized as anhedral feldspar. Observation with a microscope reveals rare biotite lamellae and a few fine flakes of muscovite. Boali sandstones are the equivalent of those of Fatima, a district located in the Bangui capital of the CAR.

Metamorphic rocks

Metamorphic rocks arise from the transformation of existing rocks, in a process called metamorphism, which means "change in form". We found four types of metamorphic rocks in our study area: Schist, Amphibolites, Itabirite, and Gneiss.

Schist: Schists are characterized by medium to large, flat, sheet-like grains with a preferred orientation. The outcroppings form in slabs on the bed of the Kassango at the roadside and are often interstratified with the sandstones. Of greenish hue this rock has a sub-vacuolar structure throughout. It presents numerous vacuoles and therefore it is strongly schistose. It fits into beds that are clear of recrystallized quartz and chlorite and has dark beds of rare sericite altered biotite. We find these in the region of Boali, and we find this same shale on the road to Damara. These are rich in mica and nodules and are very crumpled; this is the schist of Boali, the equivalent of the Fatima shale that belongs to the series of Bangui, which are above the Yangana shale.

Photo 1: sandstones of Boali falls

***Amphibolites*:** Amphibolites are dark green rocks consisting mainly of amphibole crystals more or less ordered along the planes of schistosity. We can distinguish laterized amphibolites, layered amphibolites, and massive amphibolites.

Highly altered and chloritized laterized amphibolites are found in the area of the lakes of the crocodiles in a stone quarry about 100 km away from the laterites on the highway. Layered amphibolites are amphibolites that have a banded texture characterized by alternating feldspathic quartz beds and detachment beds. The hyper-fractured veins come within 1 km of the Bogoin village (village Bobissa). Massive amphibolites are mottled with Granoblastic massive rocks. The fine-grained rocks show a discontinuity in their arrangement. The dark minerals are dominant with a cleavage of amphibole and biotite. There are also some rare glitters of muscovite. The massive amphibolites stretch from the Bogoin village to where they make contact with the granodiorites.

***Itabirite*:** The itabirites are quartzite ferruginous rubane. The outcropping is in a kilometer wide band. These are generally quartz-rich rocks occurring with magnetite and often oligiste. This last mineral concentrates in massive structures around the quartz veins crossing the Banded Iron Formation (BIF) where the banding is very marked; there is a layout of dark magnetite beds alternating with beds of clear quartzo-feldsparthic rock.

Gneiss: The gneisses are medium-grained or coarse rocks about 1 mm to 1 cm in size. They often have net foliation characterized by beds of generally dark hue, rich in minerals (mica, amphibole), and alternate with clear beds of ferromagnesian (white grey, pink) quartz and feldspar visible to the naked eye. We noted the presence of the orthogneisses, which are rocks that form a contact between amphibolites and granodiorites on one side and form a contact between the granite and granodiorites on the other side.

Other metamorphic rocks

The quartzite and muscovites rocks occupy the eastern part of the region. Shale appears in slabs on the bed of the Ngalou. Chloritoschistes and schist outcroppings occur in the region of Bogoin. Orthogneisses occupy the southern part of the region of Bogoin. The southern region of the Kolango is characterized by a lower relief that is very soft sided in its uppermost part. On the sides of the rocky massive benches, block elements, and fractured outcroppings we can distinguish massive metabasalts in the pillow lavas and metabasalts in the stringers of intruding quartz.

Deformations

Deformation takes an object from its initial state to its final state by mass transport (translation, displacement, rotation, and by internal deformation). The deformed object is defined by its dimensions.

Stratification is one form of deformation. Bedding planes illustrate the style of the planar structural element. These were initially roughly flat, horizontal surfaces. Their characteristics and variations are an imprint of deformations that have been imposed by the sedimentary terrain since their deposition. This stratification is observed in the sandstone outcropping. At the entrance to the falls of Boali we observed the stratification cross the sandstone (See Photo 1E).

Geological foliation (metamorphic arrangement in layers) with medium to large grained flakes in a preferred sheetlike or planar orientation is called schistosity. The plane of the schistosity is called S. In formations containing more competent levels, stretching leads to socking which is to say leads to the segmentation of the most competent object into fragments and socks. Photo 1D illustrates deformations characterized by boudinage, folds, faults, and shears.

- Boudinage is a term used in geology to indicate structures formed by extension (where a rigid body is deformed often into a sausage or boudin like shape).
- A fold is a permanent waveform deformation in layered rock (the rocks bend or twist). It occurs when one or a stack of originally flat surfaces (such as sedimentary rock) are permanently bent or curved.
- A fault is a fracture in the bedrock. They are breaks accompanied by the relative movement of two components. The movement can be vertical (vertical, oblique, fault normal or reverse) or horizontal (strike-slip or shear).
- A shear is the response of a rock to deformation usually by compression. The shear can be emphasized by certain minerals.

We essentially observed the schist as shears and lineaments. These are break planes that are accompanied by the relative movement of two components which show the hang of the faults. Lineaments are mineral lineations that occur during metamorphic crystallization.

In our study area there is a boudin fold ply spilled to the NW. It consists essentially of anhedral quartz crystals a centimeter in size. It is molded into the clay schist (shale) and found at the roadside in Kassango. Quartz flanges are located in the clay schist of Kassango. They can be found at the level of the boudin folds. On the road to the town's police station we find a crease spilled in sandstone. The itabirite are also very creased. The wrinkles are crooked with a very upright fold axis. Under the mast of the police station is a surrounding concentric fold with a diameter of 40 cm. The fold shown in photo 1D is observed in the clay schist (shale) of Kassango. Finally, we see a deformation characterized by a fold slumping downward. Accompanying the schistosity and the boudin is a tangential tectonic surface with direction S-SE toward N-NW. A second deformation is a tangential tectonic surface contrary to the first. It runs NW-SE. This tectonic surface is confined by the mega fold conic running N-NW. A tectonic surface relates to the structure of the Earth's crust and the large-scale processes which take place within it.

Shears**:** Sinistral and dextral shears were observed at the stone quarry (S2, See Figure 2). They form a corridor of sinistral shear 5 m wide for the S2 shears and fall 155-45° SW. The basal formation of the stone quarry shows deformation bands approximately 60 m wide. We found that the dextral shear (S2, Figure. 2) was hardly observable. On the other hand, the S2 shears are very representative of the class.

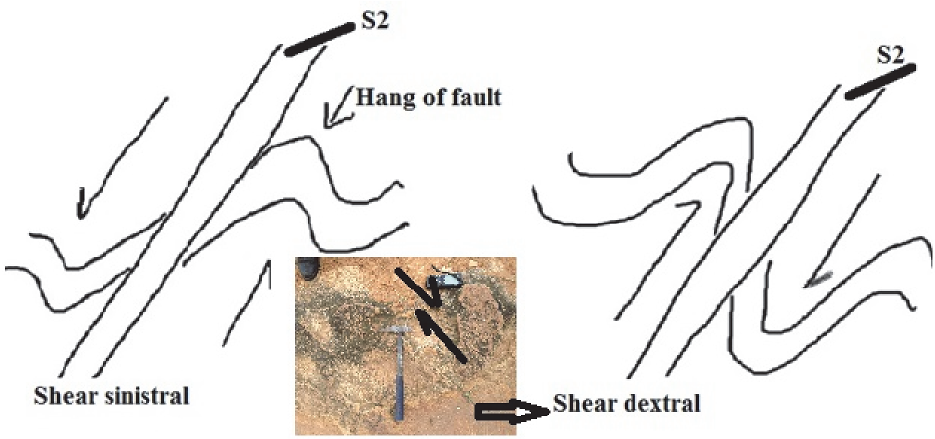

Figure 2: The center insert shows the dextral Shears in the area. The left and right sides of the figure show the sinistral shear, S2

Lineaments: The lineaments are mineral lineations during metamorphic crystallization. We observed lineaments in the sandstone towards the falls. The lineament runs N 120-35° S. It crosses all fractures. We observed in the dolerites two families of lineaments: one in direction N 135° sub-vertical; and the other, south-facing N 25° with a dip of 60°. There are small intercalations of gneiss in the outcroppings of dolerite. The thickness of these dolerites can reach 40 m. Diabase dykes continue to the top of the hill. All these formations in the sector are affected by brittle deformation which appears here as faults. The faults are the fractures in the bedrock. They are breaks accompanied by the relative movement of two components. The movement can be vertical (vertical, oblique, fault normal or reverse) or horizontal (strike-slip or shear). The fault of Boali is a normal fault (see Photo 1 E. F) corresponding to Figure 3, which shows a normal fault. These faults have been found in the sandstone in front of the police station (in the main city). They include three (3) series of fracturing. F1 and F2 in direction N 0+/-10° they have an embedding of 60 -75° E, sub-vertical; and F3 in direction N 145 +/- 10 they are sub-verticals. See Table 1 (in front of the Internet service provider for Boali, in the main city).

In addition, the brittle tectonic of the Mbi sector highlights four major series of faults: These series of faults run: N45° – N 50°; N 80° – N 100°; N130° – N 140°, corresponding to F3; and N160° – N 175° (see Table 1 (Mbi sector)).

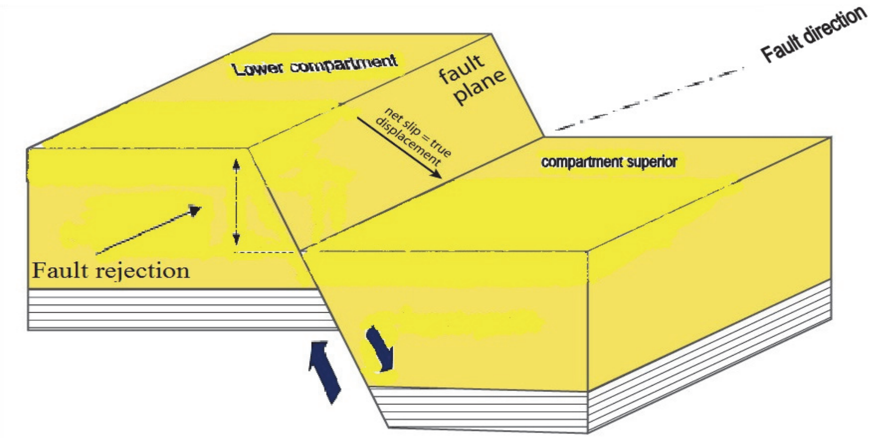

Fig. 3: the shear dextral and normal fault corresponding to the study areas observed

Locality	Outcropping	Fault	Direction and dip
In front of the Internet service provider for Boali	sandstone	faults F1 and F2	N0 – 75 E N 10. sub-vertical N 145
Sector of Mbi		fault	N45-N50 N80-N100 N130-N140 N160-N175

Table 1: faults family observed in the study areas.

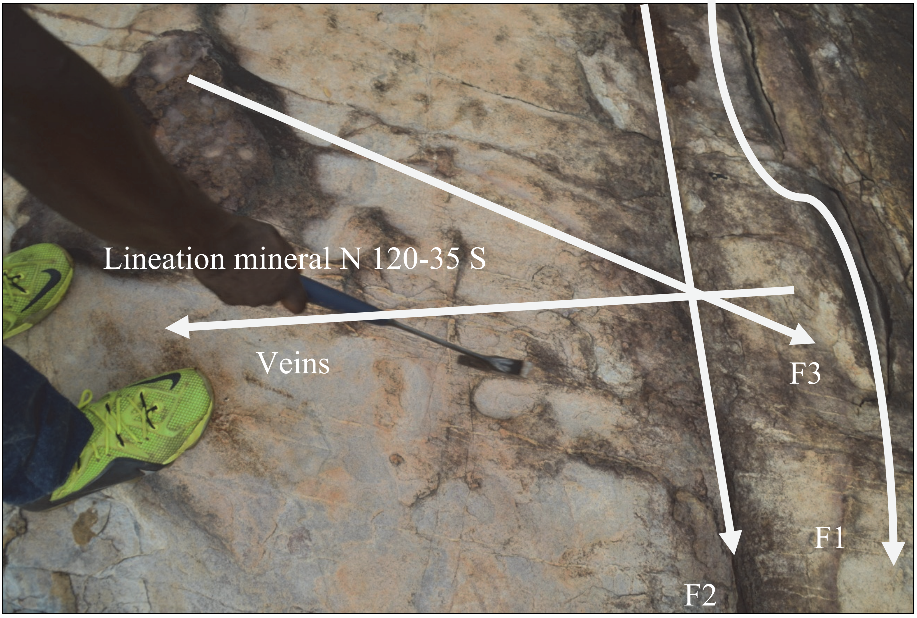

Photo 2: The basic faults and veins

Timeline for the Faults: Photo 2 shows the various fault lines we observed. First F1 was established with a filling. Then a second fault F2 parallel to F1 and included in F1 was established with a new filling of a quartz vein. A third fault F3 (also found in the area of Mbi) oblique to F1 and F2 in the direction N 145 sub-vertical, and joins with F1 and F2, accompanied by its vein filling. Finally a mineral lineament of direction and dip, N 120 – 35 S (see Photo 2), has complex features that indicate it is recent.

Structurally, D1 and D2 deformations having contrary motion show two tectonic movements, namely: tectonics of the Eburnean age (2.1 Ga) responsible for thrusting from S-E to N-W and a second pan-African age tectonics. We therefore suggest: a dating of metamorphic and sedimentary rocks to coincide with the chronology of events; an elemental geochemistry to trace for a Concordia diagram to have both the age of the formation and the age of metamorphism.

On the regional level, there is a corridor of grid cut faults towards the north of the CAR (Cornacchia and Dars, 1983) in the direction N 70° and N 40°. This is the area of strike-slip faults of the Oubanguiides.

Other setback faults with a direction N 130° to N 160° towards the sinistral fault affect all the structural units (Poidevin, 1991). These major setbacks date from the pan-African phase.

As we get closer to our study area we find different faults in the major setback of the pan-African phase described by Rolin (1992). There are two families of faults (N 45° and N 80°) that correspond to the dextral grid N 70° and N 40° of the pan-African phase. There are flaws running N 130° – N 140° corresponding to the sinistral transcurrent N 130° of pan-African water. Similarly, faults running N 160° – 175° can be classified within the family of sinistral offsets at N 160° of the pan-African phase. We found two families of shear flaws including the first sinistral flaw (N 130°) and the second dextral flaw (N 45°) as we have described. These two flaws affect both formations of Mbi.

Conclusion

The CAR is a landlocked country in Central Africa. It is divided into 16 administrative prefectures, two of which are economic prefectures, and one an autonomous commune; the prefectures are further divided into 71 sub-prefectures. Geologically CAR is a country rich in mineral resources. Our study is located in the region of Boali, which is a town located in the prefecture of Ombella M'poko. Boali is on the National Road 1 (RN1) about 100 km northwest of the Bangui capital of the CAR.

For this work we focused on the protocols set by previous studies of the geology formation in the Boali region. We also considered studies of the region by others. We include not only new information on the geologic formation of the Boali region, but also discuss the effect that non-exploitation of the granitoids in the area has on the region. The Boali region has an important reserve of granitoids, which form outcroppings and constitute the base of the region. Geologically granitoids consist essentially of quartz and feldspar (a ferromagnetic material). In region of Boali the crystals form in veins which intrude into the sedimentary and metamorphic formation. These rocks are important and useful for economic and social development.

In the region of Boali most mining is done by artisanal gold miners. Granitoids have never interested the people in the Boali region. We note that in the region of Boali, none of the local residences are made with material from the granitoids. Yet granitoids are needed for the infrastructure. In general for the CAR and in particular for the Boali region, granitoids are wealth ignored and abandoned. If the granitoids are exploited in the region of Boali, then they can contribute to the buildings; for example, tiles can be made of granitoid. Most products made with granitoids are the hardest of materials, which offer a luxury in comparison to marble tiles.

In the petrographic plane the sedimentary rocks are quite fractured and mingle with quartz veins, metamorphic and magmatic rocks. Magmatic differentiation which led to the establishment of the Diorites, the Granodiorites and Granites as well as intrusion of intermediate rocks (Dolerite) shows a bimodal magmatism confirmed by the presence of Granitoids and Ultrabasites.

The quartz from quartz veins can be made into glass for the manufacture of laboratory equipment such as: burettes, beakers, and test tubes, which are urgently needed in the Central African Republic. Quartz veins are an asset for developing jewelry workshops. We use the quartz from quartz veins in the manufacture of silicon pads, integrated circuits for audio and video devices, microprocessors for computers, solar panels, and electric watches. It is also used in gas and electronic lighters. Furthermore it can be used in construction, for coating houses, pavements, and layering of load-bearing seats.

Unfortunately for the CAR in general and for the region in particular these rocks have not been exploited. We do note, however, that it is a complex issue. Consequently the granitoids have not contributed to the social development in the CAR and Boali. In Boali unemployed youth might find productive work by artisanal mining of these reserves. The government might consider implementing a policy for medium and small business development in the areas mentioned above that might lower the high percentage of unemployment with all its consequences, not least of which are prostitution and violence. In our investigation in the region of

Boali, we conclude that currently the most important human activities are the individual artisanal agriculture production, fishing, and hunting to satisfy the daily needs.

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