

Petrographic and Geochemical Characters of Granites of the Banfora Belt, Burkina Faso (West Africa)

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Abstract

The Banfora's birimian greenstones belt is located in the western part of Burkina Faso (west Africa). Recent petrographic and litho-geochemical studies have highlighted plutons intruding the metasedimentary and metavolcanic series. These plutonic rocks are composed of leucogranites belonging to the so-called Ferkessedougou's or Ferké's batholith, granites, granodiorites, monzodiorites and quartz monzonites. From the litho-geochemical studies, these plutonic rocks have a calc-alkaline and peraluminous character. The rare earth elements spectra of the Ferké's leucogranites let distinguished two sub-facies. One of the sub-facies is composed of quartz monzonite to granite, while the other is granitic sensu stricto. However, all these plutonic rocks were emplaced in a geodynamic context of subduction followed by collision.

Keywords

Burkina Faso, Banfora, Greenstones Belt, Plutons, Geodynamic Context, Subduction

1. Introduction

The geological context of Burkina Faso is almost entirely integrated into the Baoulé-Mossi domain of the Léo-Man shield within the West African Craton (WAC) and is made up of Paleoproterozoic formations comprising the Birimian greenstone belts in the form of elongated bands with a NE-SW direction, which were accreted around 2.1 Ga during the Eburnean orogeny [1]-[4] (Figure 1).

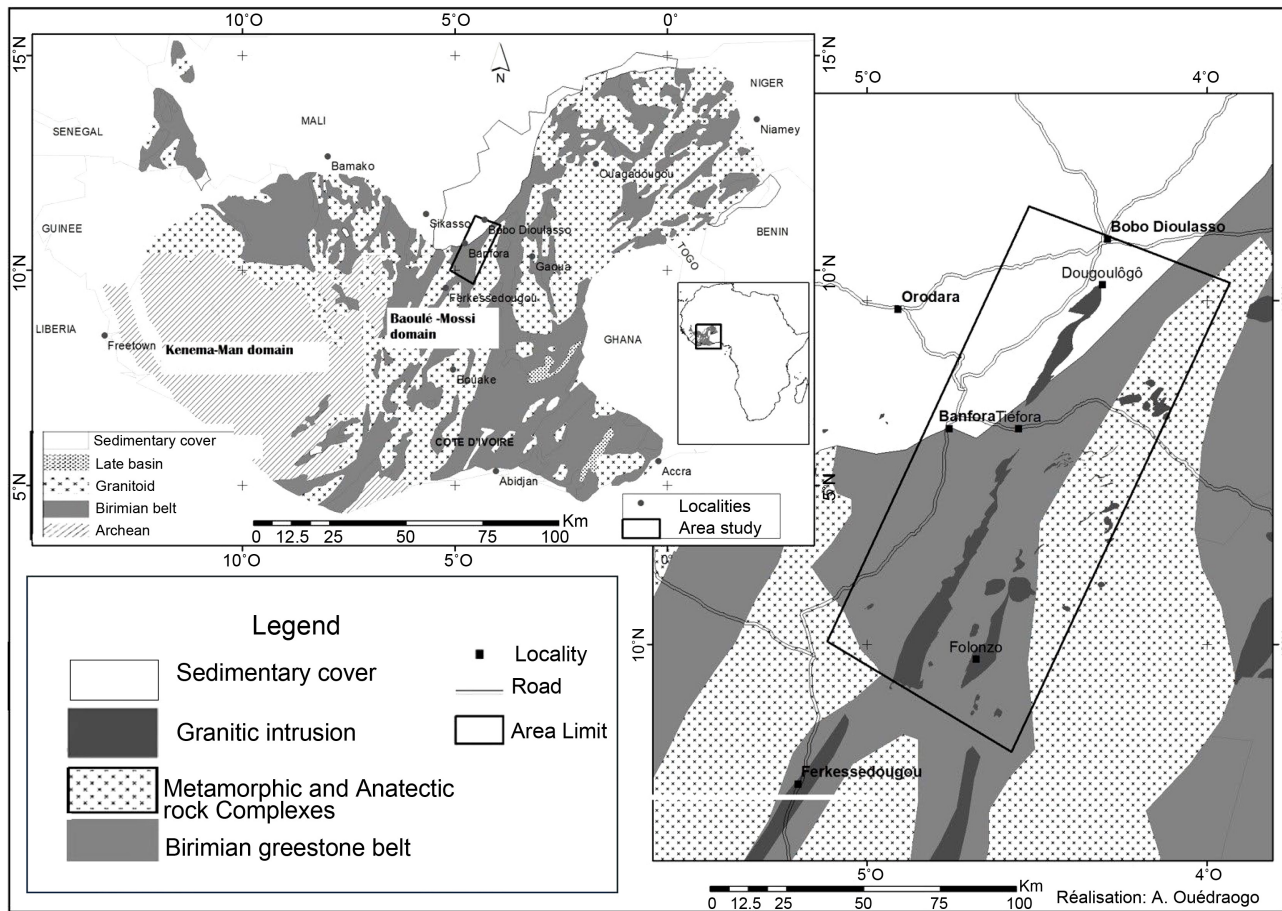


Figure 1. Position of the study area on the simplified geological map of the Leo Ridge modified [24].

These formations are alternated or injected by granitoids, which have been the subject of several studies in West Africa [5]-[12]. Authors have proposed their classification as basin-type sedimentary and volcanosedimentary granitoids, distinct from belt-type volcanic granitoids [7] [13]-[15].

The Paleoproterozoic Banfora belt is located in western Burkina Faso and continues in Côte d'Ivoire under the name of the Katiola-Marabadiassa greenstone belt and the Bandama volcanosedimentary basin [7] [16] [17] and called the Ferkessedougou domain [18] [19]. Work carried out over the last ten (10) years by various authors [3] [20] [21]-[23] focused mainly on the petrostructural and geochemical characteristics of the geological formations as a whole, and provided some radiometric ages. The belt is dominated by metasediments, and there is not only one type of granitoid that intersects this belt, as stipulated by [13]-[15], but a diversity. In order to follow in the footsteps of the previous authors, it is essential to establish a petrogeochemical analysis of the intrusive granitoids of the Banfora belt, which still remain little known.

The aim of our study is to contribute to a better understanding of these granitoids through their petrographic and geochemical constituents, to characterise their geodynamic contexts and to identify possible genetic links between them.

2. Geological Context

Geological mapping at 1:200,000 scale of the Banfora sheet, to which our study area belongs, led [4] to distinguish three main groups of geological formations (**Figure 2**): volcanosedimentary (VS) formations and metamorphic and anatectic complexes (CMA) intersected by granitic plutons. The central part of the volcanosedimentary belt is occupied by the Ferké two-mica leucogranite massifs and the Dougoulogo and Folonzo granitoids located to the north and south-east of the belt respectively. The emplacement of these plutons is thought to be associated with the activity of the Greenville-Ferkessédougou-Bobo-Dioulasso shear zone [3] [4] [23]. These three main lithologies are associated with small plutonic bodies of gabbro, diorite and veins of dolerite and pyroxenites that symbolize polyphase magmatism according to [23].

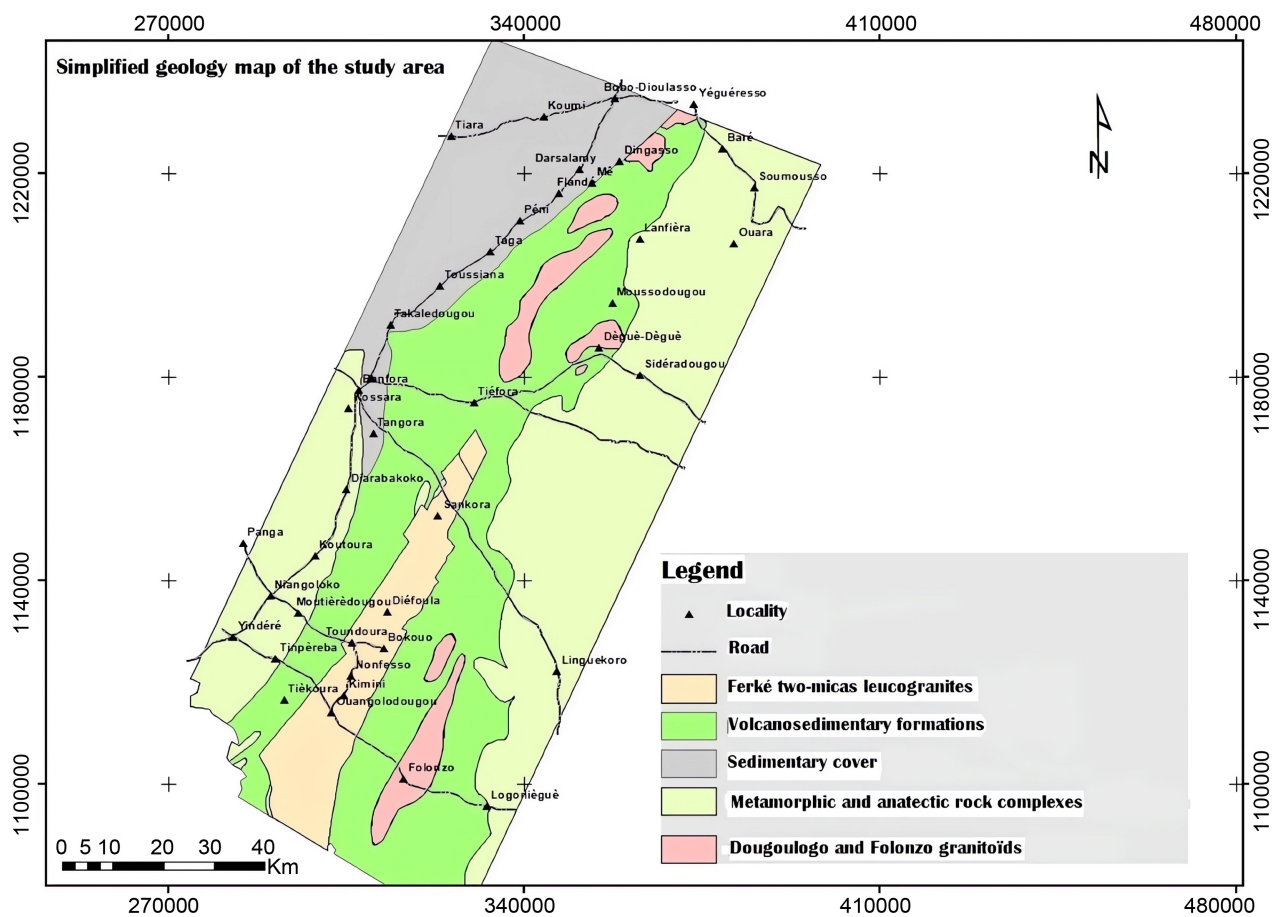


Figure 2. The simplified geological map of the study area modified [4].

3. Methodology

The mapping survey was carried out using E-W oriented sections, which enabled the various lithologies to be intersected. Representative samples were selected for thin sections and lithochemical analyses in order to provide.

The thin sections were prepared at the Petrolab laboratory in Italy and at the

Bureau des Mines et de la Géologie (BUMIGEB) in Burkina Faso. Lithochemical analyses were carried out at the Actlabs laboratory in Canada, using the Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES) method for major elements and Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS) for trace elements and rare earths.

All the field data and the results of the lithochemical analyses were processed using appropriate software (ArcMap 10.8, GCDkit 6.1).

4. Results

4.1. Petrographic and Geochemical Characteristics

4.1.1. Petrographic Characteristics

The petrographic observations made in the field and by microscopy enabled us to distinguish 3 main granitic facies. These are the granite with two (2) micas intrusive in the central part of the belt with a NE-SW elongation over several kilometers, the Dougoulogo pluton intrusive in the northern part of the belt and the Folonzo granitic intrusions in the southern part.

1) Two-mica granite

The dominant facies are the two-mica granites (**Figure 3**), an elongated batholith running NE-SW. Its NE limit is at Banfora in Burkina Faso and it extends for hundreds of kilometers into Côte d'Ivoire, where it is known as the Ferké granite (Arnould, 1960; Yobou, 1993; Ouattara, 1998). At outcrop (**Figure 3(a)**), the rock is leucocratic, medium- to coarse-grained. It is very often foliated and/or cataclased. Polarizing microscopy (**Figure 3(b)**) shows that it consists of biotite (10%), muscovite (7%), plagioclase (25%), potassium feldspar (25%) and quartz (30%). Accessory minerals (sphene, zircons, opaques, etc.) occupy around 1% of the volume of the rock. There is a notable presence of minerals such as damourite, sericite, chlorite, calcite and oxides (2%), which are minerals resulting from the partial alteration of certain primary minerals.



Figure 3. The Ferké two-mica granite in the Banfora belt: (a) Macroscopic appearance of the Ferké granite at the outcrop, (b) Microphotography of the Ferké granite. Bi: Biotite; Mi: Microcline; Mu: Muscovite; Pl: Plagioclase.

2) Dougoulogo quartz monzonite

At outcrop, quartz monzonite is a highly weathered rock with a pinkish-grey to

reddish patina (**Figure 4(a)**). The texture is grainy, heterogranular and medium-grained. In a few places it contains comagmatic enclaves. The elliptical pluton is elongated in a N-S direction for around 40 km in the same direction as the volcanosedimentary belt and is 3.5 km wide. In microscopy (**Figure 4(b)**), the main minerals observed are hornblende (10%), biotite (25%), plagioclases sometimes zoned and altered to white micas (25%), microperthitic potassium feldspars (20%) and quartz in limpid patches (10%). A few accessory minerals (zircon and apatite) and minerals resulting from the alteration of primary minerals (damourite, sericite, chlorite and opaques) are also sometimes observed.



Figure 4. Dougoulogo quartz monzonite. (a) Macroscopic aspects of the Dougoulogo quartz monzonite; (b) Microphotograph of the Dougoulogo quartz monzonite. Qz: quartz; Bi: Biotite; Pl: Plagioclase; Mi: Microcline; Am: Amphibole.

3) Folonzo granite

The entire pluton is elliptical in shape with a long axis running NW-SE for about 33 km and a short axis averaging 4.5 km. It cuts through the volcanic sequences on the eastern side of the Greenville-Ferkessédougou-Bobo-Dioulasso shear. At outcrop, the patina is light grey and the texture is coarse-grained (**Figure 5(a)**). The rock is foliated and in places contains enclaves of basic rock. Microscopically (**Figure 5(b)**), the mineralogical composition is as follows: amphiboles (0 - 10%), biotite (20%), plagioclases (20%), potassium feldspars (15%) and quartz (25%). Accessory minerals and certain minerals resulting from the alteration of primary minerals (epidote, chlorite, apatite, zircon and opaque minerals) are also observed.

4.1.2. Geochemical Characteristics

The majors of fourteen (14) granitic rock samples (**Table 1**) show that SiO₂ contents range from 54.2% to 75.1%. Al₂O₃ ranged from 14.3% to 18.3%, TiO₂ from 0 to 0.99%, Fe₂O₃ from 0.68% to 9.12%, MgO from 0.1% to 6.27%, CaO from 0.16% to 6.02%, Na₂O from 2.38% to 6.29%, K₂O from 1.71% to 5.04%, MnO from 0 to 0.19% and P₂O₅ from 0.11% to 0.49%.

The Chemical Alteration Index (CIA) of [25] was used to assess the degree of alteration of the rocks. The CIA was determined on the basis of molar proportions: $Al_2O_3 / (Al_2O_3 + CaO + Na_2O + K_2O)$. If the AIC values obtained are greater



Figure 5. Folonzo granite (a) outcrop of Folonzo granite, in scattered blocks; (b) Microphotograph of Folonzo granite showing essential minerals. Qz: Quartz; Bi: Biotite; Pl: Plagioclase; Mi: Microcline; Mu: Muscovite; Am: Amphibole.

than 92, the rocks are highly weathered, if the AIC values are between 60 and 80, they are weathered, and if the AIC is less than 60, the rocks are sound [26]. Thus, 6 rock samples have AIC values below 60, i.e. unaltered, and 8 samples have AIC values between 60 and 80, which shows that these rocks have undergone atmospheric alteration, i.e. virtually unaltered [27]. All the rocks studied do not show a high degree of alteration, which allows a good petrogenetic study.

In the [28] TAS diagram, Ferké two-mica granites are mainly found in the compositional fields of syenitic-trending quartz granites and monzonites (Figure 6(a)). They are mainly peraluminous, with values for the ratio $(Al_2O_3/(CaO + Na_2O + K_2O))$ ranging from 1.44 to 2.14 [29] and the ratio $(Al_2O_3/(CaO + Na_2O + K_2O)) > 1.1$. According to the classification of [30], these granitoids are of the “S” type and are calcoalkaline [31] (Figure 6(b) and Figure 6(c)).

In the TAS diagram (Figure 6(a)) by [28], the samples from the Dougoulogo quartz monzonite are positioned, one in the monzodiorite range and the other at the boundary between the granodiorite and quartz monzonite compositional ranges. On the same diagram, the Folonzo granite samples are one in the granodiorite range and the other at the boundary between the granodiorite and quartz monzonite compositional ranges. According to the classification of [31], these rocks are all of calc-alkaline affinity (Figure 4(b)). Plotted in the [32] diagram (Figure 6(c)), the quartz monzonite of Dougoulogo and the Folonzo granite show a peraluminous character.

These plutonic rocks maintain the same peraluminous trend in the molecular $Na_2O-Al_2O_3-K_2O$ diagram (Figure 6(d)). In addition, the ratio $(Al_2O_3/(CaO + Na_2O + K_2O))$ of these samples is > 1.1 [29]. According to the classification of [30], these granitoids are also of the “S” type. Which could mean that all of the intrusive granitoids of the Banfora belt come from the same magmatic source.

The rare earth content (ΣREE) of all the granites studied varies from 12.67 to 183.02 ppm (Table 1). Rare earth spectra normalized to the primitive mantle [33] show that the Ferké two-mica granite exhibits light rare earth enrichment relative to heavy rare earths. The rate of fractionation is moderate to high with ratios $(La/Yb) N = 6.00$ to 52.67 and $(La/Sm) N = 1.85$ to 5.24. The spectra show the

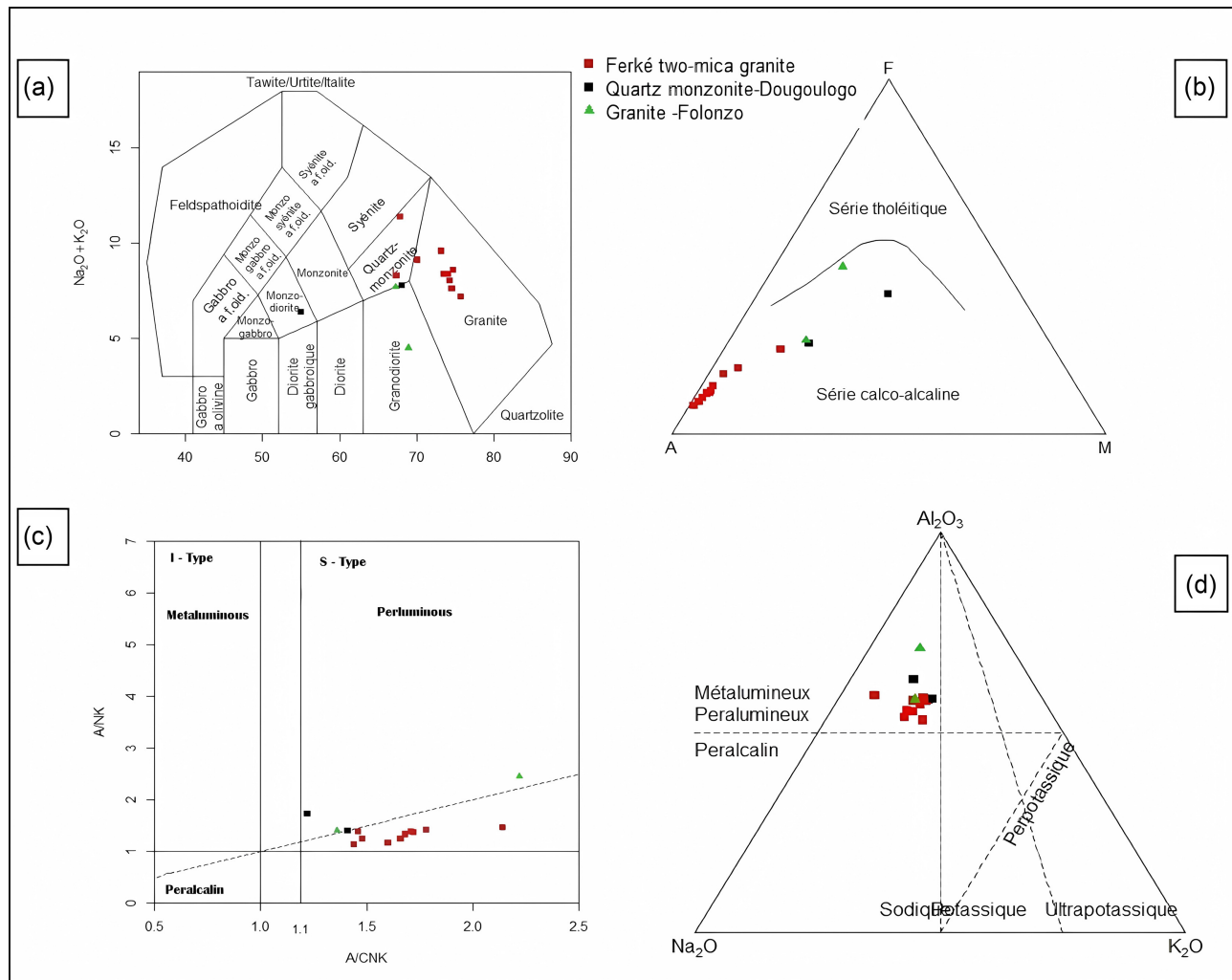


Figure 6. Positions of the Ferké, Dougoulogo and Folonzo granites in different discrimination diagrams (a) Positions in the $\text{Na}_2\text{O} + \text{K}_2\text{O}$ versus SiO_2 binary diagram [28]; (b) Positions in the AFM diagram of [31]; (c) Positions in the diagram of [32]; (d) Positions in the molecular $\text{Na}_2\text{O}-\text{Al}_2\text{O}_3-\text{K}_2\text{O}$ diagram.

existence of two subfacies in the Ferké pluton (Figure 7). Some of the samples of the two (2) mica granite of Ferké (**subfacies 1**), on average richer in REE, do not show a Europium anomaly while the others (**subfacies 2**), poorer in REE, present a more or less marked negative Europium anomaly ($\text{Eu}/\text{Eu}^* = 0.23$ to 1.13).

The spectra of Rare Earth Elements (REEs) normalized to the primitive mantle [33] of the Dougoulogo and Folonzo granitoids are similar to those of the first group (**subfacies 1**) of the two (2) mica granite of Ferké (Figure 7). These granitoids have remarkable rare earth contents ($\Sigma\text{REE} = 112.37$ to 187.97 ppm) with a (La/Yb)_N ratio varying between 10.59 and 20.84, reflecting a strong fractionation. The Eu/Eu^* ratio is 0.83 to 0.95, which shows a slight or almost no negative anomaly in europium.

From the point of view of the geodynamic context, the R2 versus R1 diagrams of [34] and [35], inform us about the geotectonic relationships of these granitoids. The data projected in the diagram of [34], indicate that the majority of the two (2)

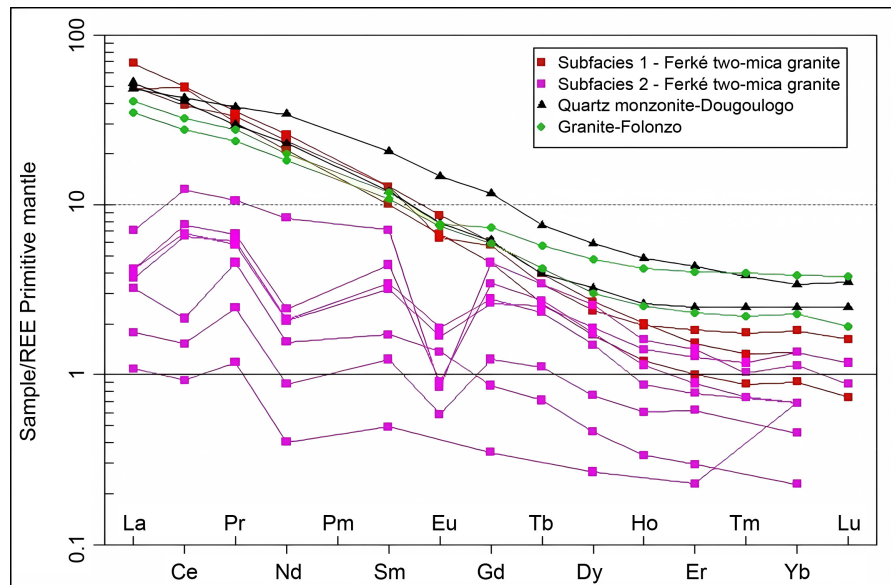


Figure 7. Normalized rare earth spectra (REEs) of the early mantle of [33] of intrusive granitoids of the Banfora volcanosedimentary belt.

Table 1. Major element (%) and trace (ppm) compositions of granitic rocks in the Banfora belt. Sf-GF 1 or 2: subfacies - Ferké granite; MQ-DG: Dougoulogo quartz monzonite; Gr-FZ: Folonzo granite.

Echantillons	M1-0149-1	M1-0214	M1-0186	M1-0214	M1-0215	M1-0211	M1-0214	M1-0187	M5-0189	M1-0189	M1-0141-2	M1-0140	M1-0221	M1-0222
Unités	Sg-GF1	Sg-GF1	Sg-GF1	Sg-GF2	Sg-GF2	Sg-GF2	Sg-GF2	Sg-GF2	Sg-GF2	Sg-GF2	Granite -DG	Granite -DG	Granite -FZ	Granite -FZ
SiO ₂	72.5	66.6	68.5	67.1	74.3	73.3	73.6	72.8	73.4	75.1	54.2	67.3	67.5	66.4
TiO ₂	0.16	0.49	0.38	0.02	0.02	0.05	0.09	0.1	0.13	0	0.99	0.39	0.58	0.36
Al ₂ O ₃	14.5	15.6	15.2	18.3	14.8	14.9	14.7	15.2	14.3	15.7	15	14.3	14.9	14.6
K ₂ O + Na ₂ O	9.5	8.2	8.91	11.26	8.55	8.29	7.97	8.29	7.49	7.13	6.29	7.7	4.39	7.61
CaO + K ₂ O + Na ₂ O	10.04	10.69	10.3	11.42	8.92	8.87	8.58	8.84	8.05	7.35	12.31	10.14	6.7	10.71
Al ₂ O ₃ /(CaO + Na ₂ O + K ₂ O)	1.44	1.46	1.48	1.60	1.66	1.68	1.71	1.72	1.78	2.14	1.22	1.41	2.22	1.36
Al ₂ O ₃ + CaO + K ₂ O + Na ₂ O	24.54	26.29	25.50	29.72	23.72	23.77	23.28	24.04	22.35	23.05	27.31	24.44	21.60	25.31
Al ₂ O ₃ /(Al ₂ O ₃ + CaO + Na ₂ O + K ₂ O)	59.09	59.34	59.61	61.57	62.39	62.68	63.14	63.23	63.98	68.11	54.92	58.51	68.98	57.68
Fe ₂ O ₃	1.43	3.46	2.44	1.43	0.96	1.22	1.42	1.31	1.75	0.68	9.12	3.92	6.22	4
MnO	0.02	0.06	0.03	0.19	0.03	0.04	0.02	0.03	0.04	0.07	0.13	0.05	0.08	0.07
MgO	0.34	1.73	0.74	0.28	0.18	0.24	0.27	0.31	0.34	0.1	6.27	2.63	1.89	2.43
CaO	0.54	2.49	1.39	0.16	0.37	0.58	0.61	0.55	0.56	0.22	6.02	2.44	2.31	3.1
2CaO	1.08	4.98	2.78	0.32	0.74	1.16	1.22	1.1	1.12	0.44	12.04	4.88	4.62	6.2

Continued

A	3.92	2.42	3.51	6.72	5.51	5.45	5.51	5.81	5.69	8.13	-3.33	1.72	5.89	0.79
B	1.93	5.68	3.56	1.73	1.16	1.51	1.78	1.72	2.22	0.78	16.38	6.94	8.69	6.79
NA ₂ O	4.46	4.34	4.66	6.29	4.73	4.06	3.58	3.83	3.58	5.42	3.43	3.35	2.38	3.95
K ₂ O	5.04	3.86	4.25	4.97	3.82	4.23	4.39	4.46	3.91	1.71	2.86	4.35	2.01	3.66
P ₂ O ₅	0.13	0.26	0.18	0.15	0.23	0.38	0.37	0.39	0.43	0.15	0.49	0.18	0.12	0.17
PF	0.62	0.65	0.68	0.49	0.75	0.84	0.92	1	1.15	1.18	1.21	0.93	1.79	0.83
TOT	99.8	99.5	98.5	99.4	100.1	99.8	100	100	99.7	100.4	99.8	99.9	99.8	99.7
A/CNK	1.44	1.46	1.48	1.6	1.66	1.68	1.71	1.72	1.78	2.14	1.22	1.41	2.22	1.36
CR	10	60	40	0	0	10	10	10	20	0	190	100	160	110
NI	10	20	11	0	0	5	6	0	0	7	74	39	55	41
CO	2.1	10.3	4.8	1.4	0.8	1.3	1.3	1.3	2.4	1	35.9	12.8	19.7	13.5
GA	29	21	21	27	24	18	22	20	25	38	21	18	18	18
V	15	55	29	7	0	0	0	5	5	6	188	69	106	70
PB	34	16	20	13	13	19	13	15	16	6	10	19	10	18
RB	269	130	138	309	353	266	248	257	302	364	87.7	128	79.3	124
CS	3.4	15.7	3.4	18.5	43.1	30.7	7.3	19.5	21	17	2.6	3.4	2.5	5.5
BA	350	1260	1280	40	50	230	80	240	70	60	800	790	460	890
SR	260	960	820	30	40	80	60	90	40	100	850	560	330	640
TA	0.6	0	0	0	2.2	1.6	0	1.7	1.5	104	0	0	0	0
NB	8	5	3	0	7	6	5	8	10	85	4	6	5	3
HF	4	4	4	1	1	1	2	1	2	4	3	4	4	3
ZR	140	180	180	18.2	23.9	41.4	58.6	43.7	57.7	23	115	127	163	130
Y	9.3	8.3	5.4	1.3	3.5	6.6	5.1	4.2	8	1.5	18.7	11.2	17.4	10.4
TH	24.2	5.2	8.7	0.9	0.8	1.2	1.4	1.3	2.9	0.5	3.9	12	6.9	9.3
U	7.47	2.53	3.13	2.57	5.29	3.11	3.63	4.67	8.87	2.2	1.31	1.66	1.83	5.15
ZN	27	71	58	84	42	37	44	84	57	16	85	41	63	56
CU	0	20	20	0	0	0	0	0	10	0	50	10	90	20
BE	6	0	0	287	7	6	0	7	7	62	0	0	0	0
W	0	0	0	0	0	1	0	1	0	0	0	0	0	0
SN	2	0	0	1	4	4	3	6	6	0	1	0	0	0
GE	1	0	0	3	2	2	1	2	2	5	1	1	2	1
SB	0	0	0	0	0	0	0	0	0	0	0.3	0.2	0.2	0.2
SC	0	6	0	0	0	0	0	0	0	0	23	8	14	9
BI	0	0.3	0	0	3.5	2.9	1	2.2	2.5	0.4	0	0.1	0	0.2
LI	70	320	40	20	260	310	100	270	240	10	40	40	50	50
MO	0	0	0	0	0	4	0	0	0	0	0	0	14	0
PD	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0

Continued

PT	0	0	0	0	0	0	0	0	0	0	0	0.6	1.1	0.8
LA	44.3	32.4	31.6	1.4	2.3	5.4	5.4	4.8	9.2	4.2	31.6	34	26.7	22.7
CE	83.6	64.9	82.1	3.1	5.1	11.4	12.8	11	20.7	7.2	71.6	68	54.3	46.8
PR	9.11	8.47	7.8	0.3	0.63	1.48	1.71	1.55	2.71	1.16	9.57	7.54	7.09	6.05
ND	32.6	29.9	26.5	1	2.2	5.2	6.1	5.3	10.5	3.9	42.8	28.8	25.1	22.9
SM	5.2	5.2	4.1	0.2	0.5	1.3	1.8	1.4	2.9	0.7	8.4	4.9	4.8	4.4
EU	0.99	1.34	1.04	0	0.09	0.26	0.14	0.29	0.13	0.21	2.27	1.2	1.19	1.15
GD	3.15	3.3	2.48	0.19	0.67	1.43	1.87	1.52	2.49	0.47	6.37	3.35	4.03	3.25
TB	0.34	0.39	0.26	0	0.11	0.25	0.27	0.23	0.34	0.07	0.75	0.39	0.57	0.42
DY	1.61	1.82	1.15	0.18	0.51	1.27	1.18	1.01	1.73	0.31	3.99	2.18	3.21	2.03
HO	0.29	0.3	0.18	0	0.09	0.21	0.17	0.13	0.24	0.05	0.72	0.39	0.63	0.38
ER	0.8	0.67	0.44	0.1	0.27	0.56	0.39	0.34	0.62	0.13	1.9	1.09	1.78	1.01
TM	0.12	0.09	0.06	0	0	0.08	0.05	0	0.07	0	0.26	0.17	0.27	0.15
YB	0.8	0.6	0.4	0.3	0.2	0.6	0.3	0.3	0.5	0.1	1.5	1.1	1.7	1
LU	0.11	0.08	0.05	0	0	0.08	0	0	0.06	0	0.24	0.17	0.26	0.13
Sum_REE	183.02	149.46	158.16	6.77	12.67	29.52	32.18	27.87	52.19	18.5	181.97	153.28	131.63	112.37
LaN/YbN	37.33	36.41	53.26	3.15	7.75	6.07	12.14	10.79	12.41	28.32	14.20	20.84	10.59	15.30
Eu/Eu*	0.75	0.99	1.00	NA	0.48	0.58	0.23	0.61	0.15	1.12	0.95	0.91	0.83	0.93

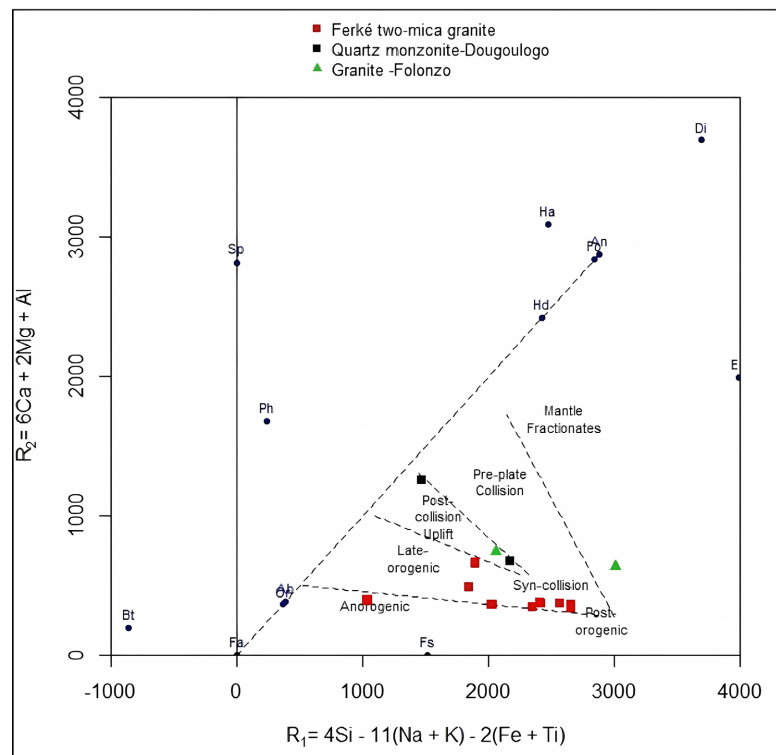


Figure 8. Intrusive granitoids of the Banfora belt in the discrimination diagram of the R1-R2 geotectonic context by [34].

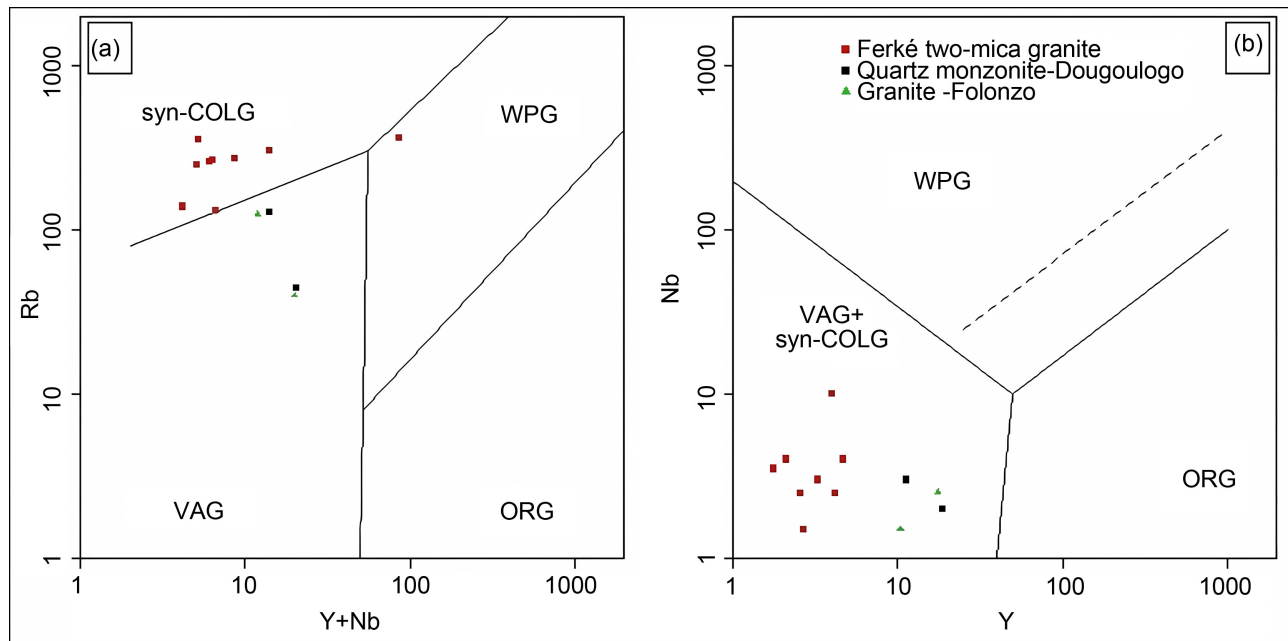


Figure 9. Intrusive granitoids of the Banfora belt in the discrimination diagram of the geotectonic context, according to [35]: (a) Rb versus (Y + Nb) and (b) Nb versus Y. GAW: volcanic arc granites; syn-COLG: syn-collisional granites; WPG: intraplate granites; ORG: granites of the mid-oceanic ridges.

mica granites of Ferké are located in the syn-collisional field (Syn-COLG) with the exception of one sample which is in the field of anorogenic granites; all the Dougoulogo granitoids and a Folonzo sample show a post-collision signature. The other sample of the Folonzo granite is located in the field of the fractional mantle (Figure 8). The Rb versus (Y + Nb) diagram of [35] (Figure 9(a)), indicates that the majority of the two-mica granites (2) of Ferké are located in the syn-collisional field (Syn-COLG) and another in the intraplate granite field (WPG), which corresponds to an enrichment in Nb and Y.

All the Dougoulogo and Folonzo granitoids fall into the volcanic arc field (VAG). In the Nb versus Y diagram (Figure 9(b)), all the samples are in the field of volcanic (VAG) and syn-collisional (Syn-COLG) arcs.

5. Discussion

Petrographic approaches to the terrain coupled with microscopic and geochemical data reveal a variety of granitoids within the Paleoproterozoic Banfora belt. They are mostly massive and show deformation marks only along small ductile and/or brittle shear corridors. These intrusives are mainly represented by the two (2) mica granites of Ferké, monzodiorites, granodiorites and quartz monzonites. Their chemical characteristics are practically similar to those of the granitoids described in other Paleoproterozoic belts by [4] [23] [36] [37]. The evolved two (2) mica granites of Ferké occupy the central part of the study area and constitute the main intrusive lithology of the belt.

The lithochemical study of these granites shows that they are mainly

peraluminous and are similar to the S-type granitoids of [30]. The diagrams of [31] and [33], suggest calcoalkaline affinity and magmatic differentiation by fractional crystallization. It also results in a strong Rb enrichment and a Sr depletion of these rocks. This intrusion is composite as indicated by rare earth spectra (**Figure 7**) and exhibits quartz to granitic monzonitic terms [33].

The facies of two-mica granites (2) from Ferké have also been identified and studied in Côte d'Ivoire [6] [36] [38] and show identical mineralogical paragenesis. As for the neighboring granitic intrusions of Dougoulogo and Folonzo, they present monzonitic to granodioritic compositions [28]. These rocks are also peraluminous in character and are of type S [30] as are the two (2) mica granites of Ferké. This assemblage of rocks also has a calcoalkaline character. These granitic assemblages with monzonitic composition identified during this study in the intrusive granitic series of the study area show lithological and lithogeochemical similarities with granitoids described by [10].

According to the R2 versus R1 diagrams of [34] and [35], the majority of the samples of the Ferké granitoids are granites emplaced in a syn-collisional geodynamic context and are therefore of supracrustal origin, which is in agreement with the work of [37] on practically the same geological formations in Côte d'Ivoire. All of the Dougoulogo and Folonzo granitic formations have a volcanic arc geochemical signature (VAG) and are thought to be of infracrustal origin [38]. Geochemical reasoning indicates that these geological formations were emplaced more precisely in a subduction mechanism. This observation is in agreement with the work of [11] [12] [39] for other studies conducted on granitoids of the same type.

6. Conclusions

The petrographic study coupled with the lithogeochemistry made it possible to understand the lithological characteristics of the intrusive formations of the Banfora belt. The lithogeochemical characterization of these intrusive granitoids gives more detail on the petrographic nature of these granitic facies which present a common calcoalkaline character and are essentially peraluminous. The two (2) Ferké granites are made up of at least two (02) subfaicès, *i.e.*, a phase of quartz and granitic monzonitic composition with a spectrum enriched in light rare earths and a mainly granitic phase with more or less flat spectra with negative europium anomalies.

As the granitic intrusions observed in the Banfora volcano-sedimentary belt are poorly documented in geochemical information, this petrogeochemical based study has made it possible to highlight the detailed geochemical characteristics of these granitic intrusions, to know their genetic relationships and the diversity of sources. All the intrusive granitic facies have a peraluminous character and have characteristics similar to those of the S-type granitoids of [30] and those MPG and CPG of [40]. From a geodynamic point of view, their emplacement would have taken place in a subduction-collision context, like most of the granitic rocks of the

West African craton [24] and [39].

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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