

1 **Petrogenesis and geochemistry of Birimian granitoids in the eastern Korhogo belt:**
2 **Geodynamic implications.**

3

4 **Abstract**

5 The Birimian formations of West Africa represent one of the most significant Paleoproterozoic
6 provinces, hosting greenstone belts and granitoid intrusions with major metallogenic potential. In
7 northern Côte d'Ivoire, the eastern Korhogo belt remains poorly documented despite its
8 economic importance. This study presents new petrographic and geochemical data on
9 granodiorites and granites from the Korhogo belt to clarify their petrogenesis and tectonic
10 setting. Petrographic observations reveal pervasive alteration, with plagioclase transformed into
11 sericite, carbonates, and epidote, and ferromagnesian minerals destabilized into chlorite and
12 epidote. Geochemical analyses show that the granitoids are calc-alkaline, potassic, and I-type,
13 ranging from metaluminous to peraluminous compositions. Their trace element patterns are
14 characterized by enrichment in large ion lithophile elements (LILE), negative Nb-Ta anomalies,
15 and strong fractionation of light rare earth elements (LREE), with variable europium anomalies.
16 These features indicate a mixed crustal and mantle origin, consistent with subduction-related
17 magmatism in a continental arc setting. The pervasive hydrothermal alteration and greenschist
18 facies metamorphism reflect post-magmatic processes associated with regional deformation and
19 fluid circulation. Overall, the Korhogo granitoids contribute to refining the geodynamic
20 framework of the Baoulé-Mossi domain and highlight the metallogenic potential of Birimian
21 terranes in Côte d'Ivoire.

22 **1. Introduction**

23 The Birimian formations of West Africa represent one of the most important Paleoproterozoic
24 provinces, composed of NE–SW oriented greenstone belts and large sedimentary basins intruded
25 by granitoid massifs and metamorphosed under greenschist facies conditions. These belts are
26 globally recognized for their metallogenic potential, particularly gold mineralization, and have
27 been studied extensively since the pioneering works of Milési et al. (1989, 1992). Côte d'Ivoire
28 alone hosts nearly 35% of these Birimian units, making it a key territory for understanding the
29 geodynamic evolution of the Baoulé-Mossi domain within the West African Craton (Bessoles,
30 1977).

31 Birimian granitoids are generally grouped into sodic TTG-type suites emplaced between 2.25
32 and 2.12 Ga and calc-alkaline, potassic suites emplaced between 2.12 and 2.09 Ga, with late
33 alkaline granites and syenites reported in Burkina Faso, Côte d'Ivoire, and Senegal (Morel
34 & Alinat, 1993; Naba et al., 2004; Tapsoba et al., 2013; Hirdes & Davis, 2002). These intrusions
35 are not only markers of crustal growth but also central to metallogenesis, as auriferous
36 mineralizations are frequently associated with shear zones at contacts between metasediments,

37 greenstone units, and granitoids (Feybesse, 2001; Gbamélé, 2012; Houssou, 2013). From a
38 regional perspective, the Korhogo belt forms part of the NE–SW oriented Birimian greenstone
39 belts that dominate the Baoulé-Mossi domain. These belts are intruded by granitoids of varying
40 affinities, ranging from sodic TTG suites to potassic calc-alkaline granitoids, emplaced between
41 2.25 and 2.09 Ga (Morel & Alinat, 1993; Naba et al., 2004; Tapsoba et al., 2013). The Korhogo
42 granitoids, however, remain less studied compared to those of the Boundiali branch, despite their
43 importance in understanding crust-mantle interactions and the geodynamic evolution of the
44 Paleoproterozoic. Thus, the study area provides a unique opportunity to investigate the
45 petrographic and geochemical characteristics of Birimian granitoids, to clarify their petrogenesis,
46 and to assess their role in the tectonomagmatic evolution of the West African Craton.

47 The Boundiali-Korhogo belt in northern Côte d’Ivoire comprises two branches: Boundiali
48 (western) and Korhogo (eastern). While Boundiali has been relatively well studied (Turner,
49 1993; Yacé, 2002), the Korhogo branch remains poorly documented despite hosting major
50 mining activities, including the Tongon deposit. Exploration programs by BHP Minerals and
51 SODEMI (1988–1994) revealed volcanosedimentary sequences of basaltic to andesitic rocks,
52 schists, felsic tuffs, and minor cherts, intruded by calc-alkaline granitoids and doleritic dykes
53 (BHP Minerals, 1994; Adegoké, 1996). These lithologies were affected by regional greenschist
54 facies metamorphism, locally reaching amphibolite facies (Feybesse, 2001; Hirdes & Davis,
55 2002). Mineralization in the Korhogo belt, as in other Birimian terranes, is closely linked to
56 shear zones controlling hydrothermal fluid circulation and gold deposition (Gbamélé, 2012;
57 Houssou, 2013).

58 However, the geochemical characterization of the Korhogo granitoids particularly rare earth
59 element fractionation patterns, trace element anomalies, and tectonomagmatic affinities remains
60 scarce. This gap limits understanding of crust-mantle interactions and geodynamic processes
61 during the Paleoproterozoic. The present study aims to provide a comprehensive petrographic
62 and geochemical characterization of granitoids from the eastern Korhogo belt to clarify their
63 mineralogical features, geochemical signatures, petrogenetic origins, and geodynamic
64 implications within the Paleoproterozoic subduction-related context of the Baoulé-Mossi
65 domain. By integrating petrographic observations and geochemical data, this work contributes to
66 refining knowledge of Birimian granitoids in Côte d’Ivoire and provides new insights into crustal
67 growth, mantle contributions, and metallogenic potential in West African terranes.

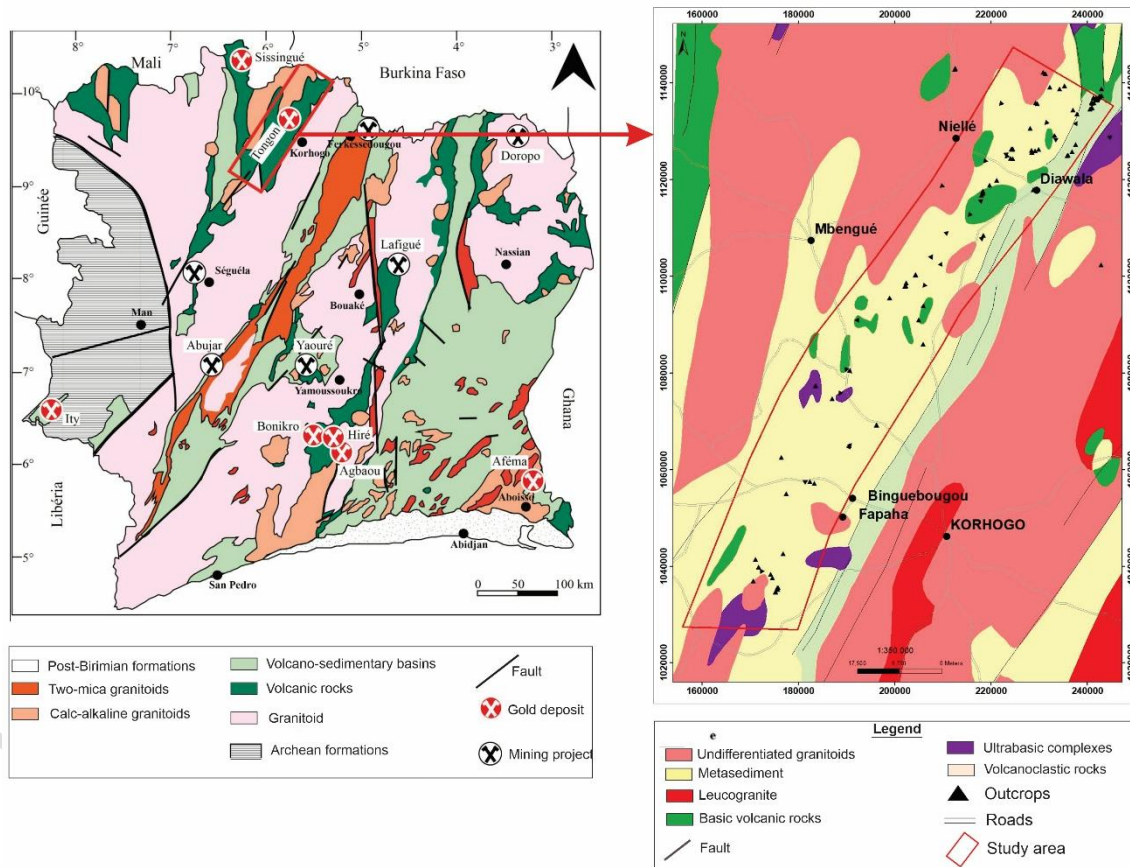
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69 **2. Study Area**

70 The study area is in northern Côte d’Ivoire, within the eastern branch of the Boundiali–Korhogo
71 greenstone belt, also known as the Korhogo belt. This belt belongs to the Baoulé-Mossi domain
72 of the West African Craton, which is bounded to the west by the Archean Kenema-Man domain
73 and separated by the Sassandra fault (Bessoles, 1977). The Korhogo belt extends across the

74 administrative regions of Poro and Tchologo and is part of the Paleoproterozoic Birimian
 75 terranes that cover nearly two-thirds of Côte d'Ivoire.

76 Geologically, the area is characterized by volcano-sedimentary sequences composed of basaltic
 77 to andesitic lavas, intercalated schists, felsic tuffs, and minor cherts, intruded by calc-alkaline
 78 granitoids and doleritic dykes (BHP Minerals, 1994; Adegoké, 1996). These lithologies are
 79 affected by regional greenschist facies metamorphism, locally reaching amphibolite facies,
 80 consistent with the metamorphic imprint observed in other Birimian belts of West Africa (Milési
 81 et al., 1989; Feybesse, 2001; Hirdes & Davis, 2002). The Korhogo belt is flanked on both sides
 82 by granitoid massifs, which play a significant role in its structural framework and metallogenic
 83 potential. The area hosts important mining activities, including the Tongon gold deposit and
 84 several promising prospects, highlighting its economic relevance (Turner, 1993; Yacé, 2002).
 85 Mineralization is closely associated with shear zones that crosscut Birimian lithologies,
 86 controlling hydrothermal fluid circulation and gold deposition (Gbamélé, 2012; Houssou, 2013;
 87 Gnanzou, 2014; Ouattara, 2015).



88
 89 **Figure 1.** Geological map of the Korhogo belt

90 **3. Methodology**

91 **3.1. Fieldwork and sampling**

92 Field investigations were conducted across several localities in the eastern Korhogo belt, notably
93 Niellé, Diawala, and Fapoha. Representative samples were collected from fresh granitoid
94 outcrops and artisanal mining sites to minimize weathering effects. A total of seven fresh
95 samples were selected, including five granodiorites and two granites, ensuring coverage of the
96 main lithological variations observed in the study area.

97 **3.2. Petrographic analysis**

98 Macroscopic observations were first carried out to describe lithological features, textures, and
99 alteration patterns. Thin sections were prepared at the Laboratoire de Géologie, Ressources
100 Minérales et Énergétiques (Université Félix Houphouët-Boigny, Abidjan). This analysis was
101 performed under transmitted light using an Optika polarizing microscope. Oxides and sulfides
102 were examined under reflected light with an Olympus BX60 microscope equipped with an
103 imaging system. This combined approach allowed detailed characterization of mineral
104 assemblages within the principal lithologies, auriferous quartz veins, and hydrothermal alteration
105 zones. Microscopic observations focused on mineral assemblages, textural relationships, and
106 alteration features. Quartz, plagioclase, amphibole, and biotite were systematically described,
107 along with secondary minerals such as chlorite, epidote, and sericite. These petrographic data
108 provided insights into magmatic crystallization processes and subsequent hydrothermal
109 overprints, highlighting pervasive alteration and fissural transformations.

110 **3.3. Geochemical analysis and data treatment**

111 Rock powders obtained after crushing were analyzed for major and trace elements. Initial
112 preparation was performed at Bureau Veritas in Abidjan, while chemical analyses were
113 conducted at Bureau Veritas Commodities Ltd (Canada). Major elements were determined using
114 Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES), whereas trace and rare
115 earth elements (REE) were measured by Inductively Coupled Plasma Mass Spectrometry
116 (ICP-MS). Analytical precision and accuracy were ensured using international standards and
117 duplicates.

118 Major element compositions were plotted on classification diagrams such as Middlemost (1994)
119 for rock type identification, Shand (1922) for alumina saturation index, and the AFM diagram of
120 Irvine & Baragar (1971) to distinguish tholeiitic versus calc-alkaline affinities. Trace element
121 data were normalized to the primitive mantle (Sun & McDonough, 1989) to highlight enrichment
122 in large ion lithophile elements (LILE) and anomalies in high field strength elements (HFSE).
123 Rare earth element patterns were normalized to chondritic values, allowing evaluation of
124 fractionation trends and anomalies in Ce and Eu. These results were then compared with regional
125 Birimian granitoid suites described in Côte d'Ivoire, Burkina Faso, and Senegal (Morel & Alinat,

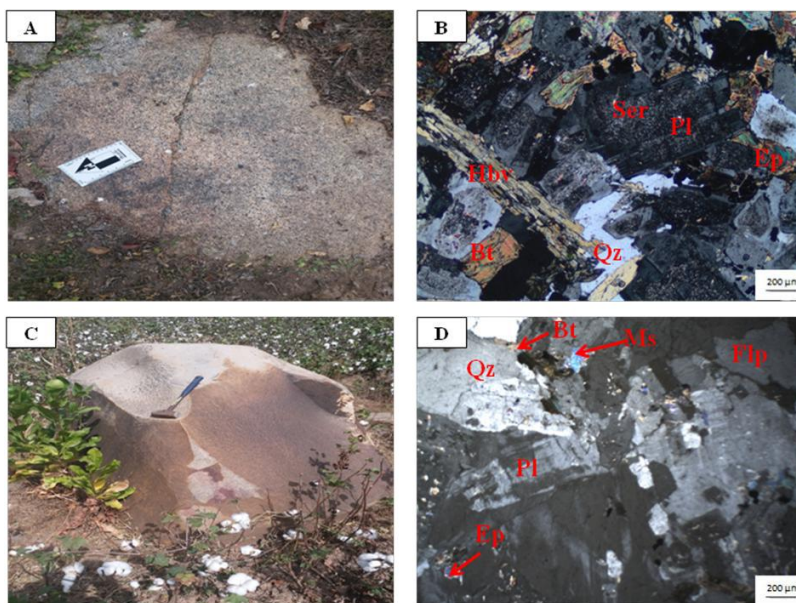
126 1993; Naba et al., 2004; Tapsoba et al., 2013; Hirdes & Davis, 2002), providing a framework for
127 interpreting crust-mantle interactions and subduction-related magmatism (Pearce, 1983; Pearce
128 et al., 1984).

129 4. Results

130 4.1 Petrography

131 **Granites:** The granites, which are widespread throughout the study area, are coarse-grained and
132 intrusive into metabasalts (Fig.2C). They are traversed by quartz veins and locally exposed along
133 riverbanks and consist of quartz, feldspar, and biotite crystals, with microcline and orthoclase
134 locally observed. Plagioclase is partially altered to sericite and epidote, while biotite shows
135 incipient chloritization (Fig. 2D). Muscovite is less abundant, and opaque minerals occur in
136 minor amounts. Quartz displays a characteristic rolling extinction. Biotite is present, with some
137 sections showing incipient chloritization, which is more abundant than muscovite. Microcline,
138 orthoclase, and opaque minerals are also observed.

139 **Granodiorite:** Samples were collected from the localities of Niellé, Diawala, and Fapoha. In
140 outcrop, the rocks are massive, mesocratic, and display granular to porphyroid textures, intruding
141 into metabasalts. Several specimens were obtained from artisanal gold mining zones.
142 Macroscopic examination reveals quartz, plagioclase, amphibole, biotite, as well as sulfides and
143 oxides. Under the microscope, the rocks are generally composed of quartz, plagioclase, green
144 hornblende, and biotite (Fig. 2A). Quartz commonly occurs as phenocrysts with distinctive
145 rolling extinction. Plagioclase also appears as phenocrysts, often altered and transformed into
146 sericite, carbonates, and epidote, with magmatic zoning visible in some sections (Fig. 2B). Green
147 hornblende is typically of medium grain size, while biotite, locally associated with hornblende,
148 contains zircon inclusions. These ferromagnesian minerals frequently destabilize into chlorite
149 and epidote. Additionally, fine veinlets of quartz-sericite are observed, associated with chlorite,
150 sulfides, and oxides.



151

152 **Figure 2.** Granodiorites and granites: macroscopic and microscopic views. (A–B) Macroscopic
 153 and microscopic views of granodiorites; (C–D) Macroscopic and microscopic views of granites.
 154 Mineral abbreviations: Ms = muscovite; Flp = feldspars; Hbv = green hornblende; Bt = biotite

155 4.2 Geochemistry

156 4.2.1 Major Elements

157 The major element compositions classify the rocks as granodiorites and granites according to
 158 Middlemost (1994) (Fig. 3A). The granodiorites show SiO₂ contents ranging from 65.13 to
 159 67.84%, MgO from 1.37 to 2.95%, Fe₂O₃ between 3.80 and 5.47%, and Al₂O₃ from 9.55 to
 160 15.77%. Na₂O and K₂O vary respectively from 2.72–4.93% and 0.61–3.21%, while TiO₂ remains
 161 low (0.40–0.57%). The granodiorites exhibit chemical compositions consistent with calc-alkaline
 162 rocks (Fig. 3B). Normative quartz contents range from 16.49 to 31.35%, hypersthene from 2.81
 163 to 5.45%, and diopside from 1.34 to 4.15% (Table I). Notably, sample T02-1 contains no
 164 normative diopside. In addition, normative olivine is absent in all these rocks.

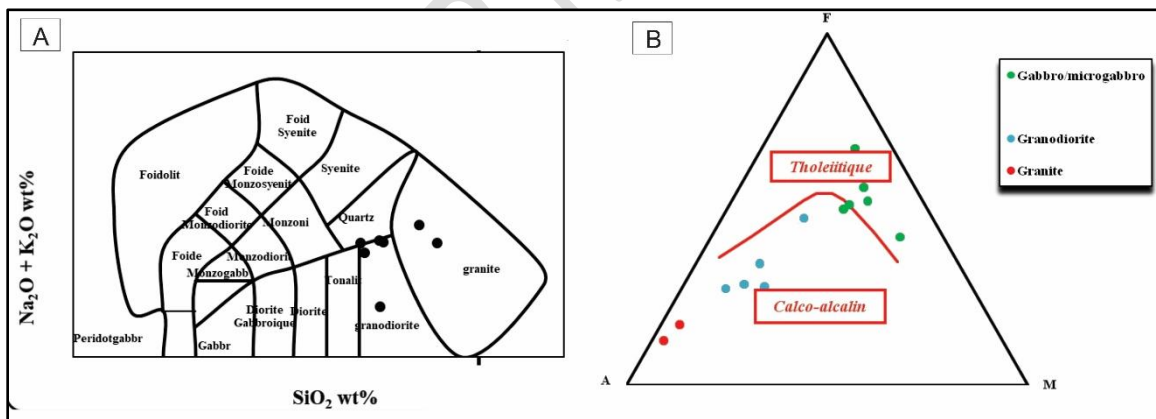
165 The granites are richer in silica (72.27–74.42%) and alkalis (Na₂O = 4.65–5.37%; K₂O = 2.14–
 166 4.03%), with lower MgO (0.27–0.52%) and Fe₂O₃ (1.25–2.13%). On Shand's (1922) diagram,
 167 granodiorites plot in the metaluminous field, while granites are peraluminous (Fig. 4A). The
 168 AFM diagram of Irvine & Baragar (1971) confirms a calc-alkaline affinity typical of
 169 subduction-related magmatism (Fig. 4B).

170

171 **Table I.** Normative compositions of granodiorites from the Korhogo belt.

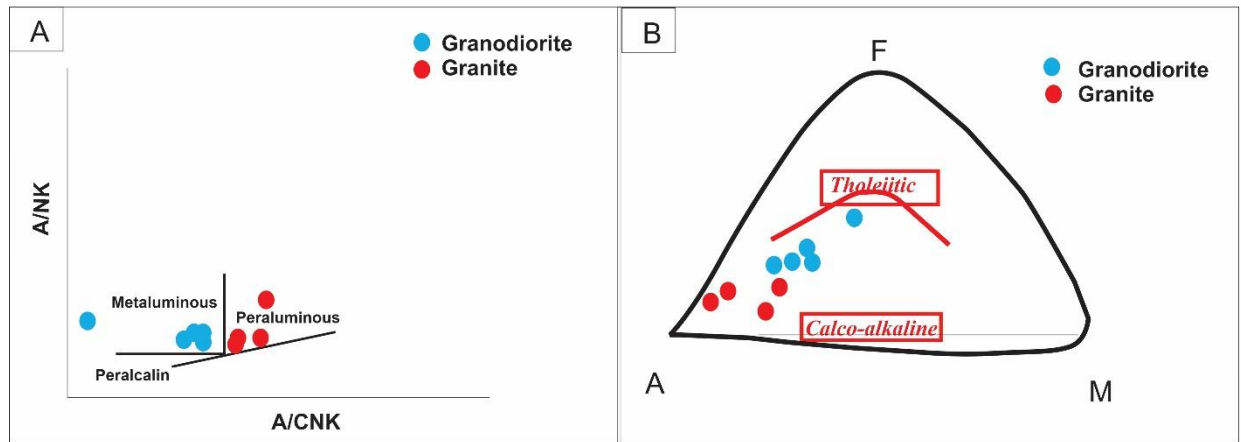
	Granodiorite DIA 21	Granodiorite DIA 25	Granodiorite FAP 7	Granodiorite N 02-1	Granodiorite N10
Apatite	0,28	0,39	0,37	0,26	0,40
Ilmenite	0,17	0,19	0,15	0,22	0,17
Orthose	17,38	14,08	16,14	3,59	19,01
Leucite	0,00	0,00	0,00	0,00	0,00
Kaliophyllite	0,00	0,00	0,00	0,00	0,00
Albite	39,00	37,95	41,70	22,98	36,04
Nepheline	0,00	0,00	0,00	0,00	0,00
Anorthite	10,23	13,91	12,78	12,04	12,55
Titanite	0,76	1,13	0,84	0,84	0,95
Perovskite	0,00	0,00	0,00	0,00	0,00
Rutile	0,00	0,00	0,00	0,00	0,00
Corindon	0,00	0,00	0,00	0,00	0,00
Aegyrine	0,00	0,00	0,00	0,00	0,00
Magnetite	0,00	0,00	0,00	0,00	0,00
Hematite	4,27	5,33	3,80	5,47	4,50
Diopside	2,87	2,80	1,34	0,00	4,15
Wollastonite	0,45	0,67	0,50	18,17	0,56
Larnite	0,00	0,00	0,00	0,00	0,00
Hypersthene	3,71	4,23	2,81	5,31	5,45
Olivine	0,00	0,00	0,00	0,00	0,00
Silice	21,09	19,63	19,82	31,35	16,49

172
173



174

175 **Figure 3.** Geochemical diagrams of granitoids from the eastern branch of the Korhogo belt, with
 176 (A) the Middlemost (1994) classification diagram applied to the Korhogo granitoids and (B) the
 177 AFM diagram illustrating the geochemical trends of the plutonic rocks.



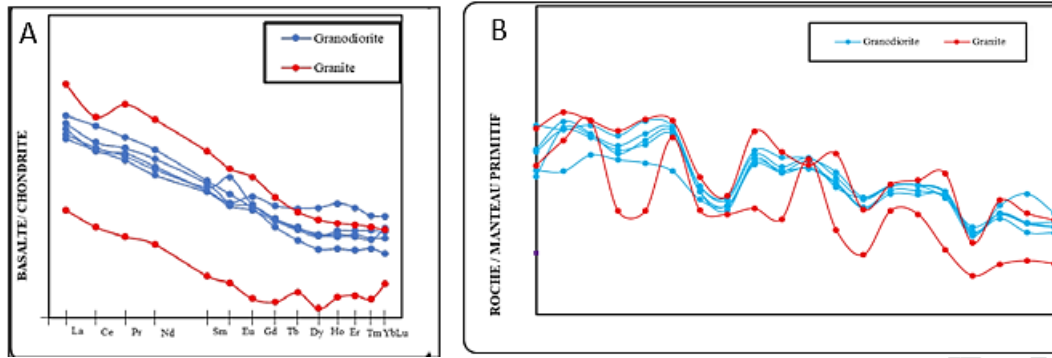
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179 **Figure 4.** Geochemical diagrams of granitoids from the eastern branch of the Korhogo belt, with
 180 (A) the Shand (1922) classification diagram applied to the Korhogo granitoids and (B) the AFM
 181 diagram of Irvine and Baragar (1971) illustrating the geochemical characteristics of the Korhogo
 182 granitoids.

183 4.2.2 Trace elements and Rare Earth Elements (REE)

184 Trace element data reveal enrichment in large ion lithophile elements (LILE) such as Cs, Ba, Rb,
 185 and K, and depletion in high field strength elements (HFSE) like Nb and Ta, producing negative
 186 Nb-Ta anomalies. The total REE content (Σ REE) in granodiorites ranges from 90.62 to 145.94
 187 ppm, while granites vary between 16.72 and 243.58 ppm. Chondrite-normalized REE patterns
 188 (Sun & McDonough, 1989) show strong enrichment in light rare earth elements (LREE) with
 189 moderate to high fractionation [$(La/Sm)_N = 4.51 - 4.69$ et $(La/Yb)_N = 7.63 - 26.53$], and
 190 depletion in heavy rare earth elements (HREE) [$(Gd/Yb)_N = 1.00-3.13$] (Fig.5A). The granitoids
 191 display enrichment levels ranging from 1 to 25 times the chondritic values. They typically
 192 exhibit a slightly negative to positive europium anomaly ($Eu/Eu^* = 0.90-1.11$) and negative
 193 cerium anomalies ($Ce/Ce^* = 0.60-0.92$). The negative Ce anomaly is characteristic of modern
 194 arc magmas but may also result from post-magmatic processes, such as extensive hydrothermal
 195 fluid circulation (Abouchami et al., 1990; Sylvester & Attoh, 1992).

196 Multi-element spectra normalized to the primitive mantle (Fig. 5B) reveal significant
 197 enrichments in large-ion lithophile elements (LILEs: Cs, Rb, Ba, K), accompanied by general
 198 negative anomalies in Nb, Ta, P, Ti, and V. Such geochemical signatures—particularly Ba and Sr
 199 enrichment coupled with Nb, Ta, and Ti depletion—are typical indicators of subduction-related
 200 environments.



201

202 **Figure 5.** (A) Rare earth element (REE) spectra normalized to chondrites for granitoids of the
 203 Korhogo belt. (B) Multi-element spectra normalized to the primitive mantle for granitoids of the
 204 Korhogo belt.

205 **5. Discussion**

206 **5.1 Comparison with regional Birimian granitoids**

207 The Korhogo granitoids exhibit petrographic and geochemical features consistent with Birimian
 208 granitoids described in other West African terranes. Their calc-alkaline affinity, potassic nature,
 209 and I-type character are comparable to granitoids reported in Burkina Faso, Ghana, and Senegal
 210 (Morel & Alinat, 1993; Naba et al., 2004; Tapsoba et al., 2013; Sylvester, 1994; Hirdes & Davis,
 211 2002). The enrichment in LILE and depletion in Nb-Ta observed in the Korhogo granitoids are
 212 typical of subduction-related magmatism, confirming their emplacement in a continental arc
 213 setting. However, the variability in europium anomalies and the pervasive hydrothermal
 214 alteration distinguish them from less altered granitoids in the Boundiali branch, suggesting local
 215 processes of fluid circulation and post-magmatic modification (Taylor & McLennan, 1985;
 216 Rollinson, 1993).

217 **5.2 Petrogenesis and Crust-Mantle Interactions**

218 The geochemical signatures of the Korhogo granitoids indicate a mixed origin involving both
 219 crustal and mantle contributions. The strong fractionation of LREE relative to HREE, coupled
 220 with negative Nb-Ta anomalies, supports derivation from partial melting of a crustal source
 221 influenced by mantle inputs. The coexistence of metaluminous granodiorites and peraluminous
 222 granites suggest variable degrees of crustal assimilation and fractional crystallization. These
 223 findings align with models of Paleoproterozoic crustal growth in the Baoulé-Mossi domain,
 224 where TTG suites represent early crustal accretion and calc-alkaline granitoids reflect subsequent
 225 arc magmatism (Condie, 1997; Martin, 1994; Sylvester, 1994).

226 **5.3 Petrogenetic and Geodynamic Implications**

227 The combined petrographic and geochemical evidence suggests that the granitoids of the
228 Korhogo belt originated from partial melting of a crustal source with mantle contributions. Their
229 calc-alkaline and potassic nature, together with metaluminous to peraluminous character,
230 supports emplacement in a continental arc setting during the Paleoproterozoic. The pervasive
231 hydrothermal alteration and greenschist facies metamorphism reflect post-magmatic processes
232 associated with regional deformation and fluid circulation. Overall, the granitoids of the eastern
233 Korhogo belt record the interaction between crustal and mantle materials in a subduction-related
234 geodynamic context, contributing to the understanding of crustal growth and magmatic evolution
235 within the Baoulé-Mossi domain of the West African Craton (Milési et al., 1989; Milési et al.,
236 1992; Pearce, 1983; Pearce et al., 1984).

237 **6. Conclusion**

238 The granitoids of the eastern Korhogo belt provide new insights into the Paleoproterozoic
239 evolution of the Baoulé-Mossi domain within the West African Craton. Petrographic
240 observations reveal that these rocks are predominantly granodiorites and granites, affected by
241 pervasive hydrothermal alteration and greenschist facies metamorphism. Geochemical analyses
242 classify them as calc-alkaline, potassic, and I-type granitoids, with metaluminous granodiorites
243 and peraluminous granites reflecting variable crustal assimilation and fractional crystallization.
244 Their trace element and REE patterns show enrichment in LILE, depletion in Nb-Ta, strong
245 LREE fractionation, and variable Eu anomalies, consistent with subduction-related magmatism.
246 The integration of petrographic and geochemical data demonstrates that the Korhogo granitoids
247 originated from partial melting of a crustal source with mantle contributions, emplaced in a
248 continental arc setting during the Paleoproterozoic. The pervasive alteration and structural
249 control by shear zones highlight the role of post-magmatic processes in modifying their
250 geochemical signatures and enhancing their metallogenic potential. Comparisons with granitoids
251 from Burkina Faso, Ghana, and Senegal confirm that the Korhogo belt shares regional features of
252 Birimian magmatism, while also exhibiting local variations linked to hydrothermal activity and
253 crust-mantle interactions. Ultimately, this study bridges the gap between regional geological
254 frameworks and local geochemical signatures, refining our understanding of crustal growth,
255 mantle contributions, and tectonomagmatic processes in Birimian terranes. The results
256 underscore the geodynamic significance of the Korhogo granitoids in the stabilization of the
257 West African Craton and their metallogenic importance for gold mineralization. Future work
258 should integrate geochronological constraints and isotopic studies to further clarify the timing,
259 sources, and evolution of these granitoids within the broader Paleoproterozoic geodynamic
260 context.

261 **References**

262 Adegoké, O. (1996). Exploration report on volcanosedimentary sequences of northern Côte
263 d'Ivoire. SODEMI archives.

264 Bessoles, B. (1977). *Géologie de l’Afrique : Le craton ouest-africain*. Paris : BRGM.

265 BHP Minerals. (1994). *Exploration program report, Côte d’Ivoire*. Internal company report.

266 Condie, K. C. (1997). *Plate tectonics and crustal evolution* (4th ed.). Oxford: Butterworth-

267 Heinemann.

268 Feybesse, J. L. (2001). Tectonic evolution and metallogeny of the Birimian in West Africa.

269 *Journal of African Earth Sciences*, 33(1), 211–234.

270 Gbamélé, S. (2012). Structural controls of gold mineralization in Côte d’Ivoire. *African*

271 *Geoscience Review*, 19(2), 145–160.

272 Gnanzou, J. (2014). Hydrothermal fluid circulation and gold deposition in Birimian terranes.

273 *West African Journal of Geology*, 12(3), 77–95.

274 Hirdes, W., & Davis, D. W. (2002). U-Pb geochronology of Paleoproterozoic rocks in Ghana

275 and Burkina Faso: Implications for the timing of Birimian and Tarkwaian events. *Precambrian*

276 *Research*, 114(1–2), 27–53.

277 Houssou, K. (2013). Auriferous mineralization in shear zones of northern Côte d’Ivoire. *Journal*

278 *of Mining and Geology*, 49(1), 23–34.

279 Irvine, T. N., & Baragar, W. R. A. (1971). A guide to the chemical classification of the common

280 volcanic rocks. *Canadian Journal of Earth Sciences*, 8(5), 523–548.

281 Martin, H. (1994). The Archean grey gneisses and the genesis of continental crust. *Precambrian*

282 *Research*, 65(1–4), 1–26.

283 Middlemost, E. A. K. (1994). Naming materials in the magma/igneous rock system. *Earth-*

284 *Science Reviews*, 37(3–4), 215–224.

285 Milési, J. P., Ledru, P., Feybesse, J. L., Dommaget, A., & Marcoux, E. (1989). Les

286 minéralisations aurifères de l’Afrique de l’Ouest : Leur contexte géologique et leur signification

287 métallogénique. *Chronique de la Recherche Minière*, 497, 3–98.

288 Milési, J. P., Ledru, P., Feybesse, J. L., Dommaget, A., & Marcoux, E. (1992). The

289 metallogenic significance of the Birimian province of West Africa. *Ore Geology Reviews*, 7(1),

290 25–54.

291 Morel, J., & Alinat, J. (1993). Les granitoïdes birimiens du Burkina Faso : Pétrologie et

292 géochimie. *Bulletin de la Société Géologique de France*, 164(6), 799–810.

293 Naba, S., Lompo, M., & Béziat, D. (2004). Geochemistry and geochronology of Birimian

294 granitoids in Burkina Faso. *Journal of African Earth Sciences*, 39(1–2), 1–22.

295 Ouattara, G. (2015). Structural evolution and gold mineralization in the Birimian belts of Côte

296 d’Ivoire. *African Earth Sciences Journal*, 21(2), 101–118.

297 Pearce, J. A. (1983). Role of subcontinental lithosphere in magma genesis at active continental

298 margins. In C. J. Hawkesworth & M. J. Norry (Eds.), *Continental basalts and mantle xenoliths*

299 (pp. 230–249). Shiva Publishing.

300 Pearce, J. A., Harris, N. B. W., & Tindle, A. G. (1984). Trace element discrimination diagrams

301 for the tectonic interpretation of granitic rocks. *Journal of Petrology*, 25(4), 956–983.

302 Rollinson, H. (1993). *Using geochemical data: Evaluation, presentation, interpretation*. London:

303 Longman.

304 Shand, S. J. (1922). The problem of the alkaline rocks. Proceedings of the Geological Society of
305 London, 78(1), 74–82.

306 Sun, S. S., & McDonough, W. F. (1989). Chemical and isotopic systematics of oceanic basalts:
307 Implications for mantle composition and processes. In A. D. Saunders & M. J. Norry (Eds.),
308 Magmatism in the ocean basins (pp. 313–345). Geological Society Special Publication No. 42.

309 Sylvester, P. J. (1994). Archean granite–greenstone belts: Petrogenetic models and modern
310 analogues. *Precambrian Research*, 65(1–4), 1–33.

311 Tagini, B. (1972). Carte géologique de la Côte d’Ivoire au 1/200,000 et notice explicative.
312 Abidjan : Direction de la Géologie.

313 Taylor, S. R., & McLennan, S. M. (1985). The continental crust: Its composition and evolution.
314 Oxford: Blackwell.

315 Turner, D. C. (1993). Geology of the Boundiali belt, northern Côte d’Ivoire. Abidjan: SODEMI
316 Technical Report.

317 Yacé, P. (2002). Lithological and structural study of the Boundiali belt. Abidjan: Université de
318 Cocody.

319