

Geochemistry of Alluvial Deposits from the Mouanko Region (Littoral Basin, Cameroon): Implications for Provenance, Depositional Environment, and Associated Mineralizations

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Abstract

The siliciclastic sedimentary formations of the Cameroonian Littoral Basin preserve crucial indicators of the paleoclimatic and geodynamic evolution of the Central African Atlantic margin. This study focuses on the lithogeochemical characterization of clays, sandstones, and conglomerates from the Mouanko region (Douala sub-basin) to determine their provenance, reconstruct their depositional environment, and evaluate the potential of associated mineralizations. In the absence of X-ray diffraction (XRD) data, a quantitative multi-element approach using X-ray fluorescence (XRF) and inductively coupled plasma mass spectrometry (ICP-MS) was applied. The results reveal three distinct geochemical poles. The first, an aluminous pole (residual clays), displays high Al_2O_3 contents (23.1–25.5%) and high loss on ignition (LOI: 12.4–13.7%), associated with an extreme Chemical Index of Alteration (CIA) exceeding 99%. This signature reflects complete continental hydrolysis under a hot, super-humid paleoclimate, which promoted the neoformation of kaolinite. The second, a potassic-alkaline pole (arkosic sandstones), exhibits a moderate CIA (55–60%), indicating chemical immaturity linked to rapid mechanical erosion and short transport distances from the crystalline (basement) during local tectonic reactivations. The third pole is distinguished by high secondary Fe_2O_3 concentrations (17.9–19.7%), reflecting supergene lateritic induration processes or diagenetic cementation in an oxic to suboxic environment. Although the potential for base and precious metals (Au, Ag, Cu, Pb, Zn) is negligible, the explored area holds significant economic potential for non-metallic substances. The characteristics of the aluminous pole open concrete perspectives for the local industrial valorization of ceramic materials and construction eco-materials.

1. INTRODUCTION

The sedimentary basin of the Cameroonian Littoral, also known as the Douala/Kribi-Campo Basin, constitutes a key segment of the equatorial Central African passive margin, whose evolution is intimately linked to the opening of the South Atlantic during the Early Cretaceous [22, 21, 15, 16, 34–36]. According to the tectono-stratigraphy established by [21] and completed by [8], the transition between continental inputs from the Congo Craton or the crystalline basement and coastal sedimentation generated complex siliciclastic successions. The Mouanko region, ideally located in this transitional zone of the Douala sub-basin, hosts extensive sedimentary formations dominated by clays, sandstones, and conglomerates [31]. The study of these sedimentary series is of dual interest: first, it allows for the reconstruction of the paleoclimatic and geodynamic history of the African Atlantic margin, and second, it provides an opportunity to evaluate the economic potential of the associated mineral substances.

Although the general stratigraphy of the Littoral Basin is well-documented by reference works [29, 21, 5, 37, 23, 28], local lithogeochemical variations within specific sectors like Mouanko remain poorly understood. Furthermore, the frequent absence of stratigraphic fossils or clear biostratigraphic markers in these coarse- to fine-grained series complicates traditional paleoenvironmental reconstructions. In the absence of X-ray diffraction (XRD) data to directly characterize mineralogical assemblages, the geochemistry of major and trace elements provides a robust alternative. Geochemical signatures, based on the behavior of immobile elements and Rare Earth Element (REE) ratios, yield reliable indicators to discriminate the nature of source rocks, quantify the intensity of continental weathering, and define the tectonic setting of deposition.

Moreover, supergene weathering processes and sedimentary diagenesis in this equatorial zone raise important metallogenic questions, particularly regarding the genesis of iron concentrations and the purity of clay horizons. The identification of high variations in iron oxide (Fe_2O_3) contents within these formations suggests mechanisms of sedimentary enrichment or lateritic induration that need to be characterized to assess their economic and industrial significance.

This paper aims to address these gaps using a quantitative multi-element geochemical approach. Based on X-ray fluorescence (XRF) and inductively coupled plasma mass spectrometry (ICP-MS) analyses of samples from the Mouanko region, this work specifically intends to: (i) chemically classify the different encountered sedimentary lithologies; (ii)

determine the provenance of the sediments as well as the paleoclimatic conditions governing their deposition; and (iii) discuss the origin and nature of the iron concentrations identified in the explored sector.

2. GEOLOGICAL SETTING

The sedimentary basin of the Cameroonian Littoral extends along the maritime coastline of Cameroon (Fig. 1). This passive margin basin belongs to the vast Central and West African Rift System (WCARS), whose genesis resulted from the breakup of the Gondwana supercontinent and the subsequent opening of the South Atlantic Ocean during the Early Cretaceous [29, 21, 13, 5]. The geodynamic evolution of the basin is classically divided into three major tectonic stages [1, 2, 11, 10, 30]: the pre-rift phase (Hauterivian to Barremian), the syn-rift phase (Early to Middle Aptian), and the post-rift or drift phase (Late Aptian to Present).

The Mouanko study area is geographically located in the lower Sanaga valley, a pivotal transitional zone of the Douala sedimentary sub-basin (Fig. 1). In this region, the sedimentary cover rests with a major unconformity on the Precambrian Basement Complex, which consists mainly of gneisses, migmatites, and granitoids [17, 32, 33, 12, 4, 19]. The local stratigraphic column is characterized by an alternation of terrigenous formations belonging mainly to the Early to Middle Cretaceous units [25]: (i) The Mundeck Formation (Aptian to Albien): This is the main basal terrigenous unit, composed of alternating coarse polygenic conglomerates, coarse- to medium-grained sandstones (often arkosic or feldspathic), and micaceous silty clay levels. The sediments of this formation were deposited in high-energy continental to transitional environments, such as alluvial cones and fluvio-deltaic systems [9]; (ii) The Logbadjeck Formation (Cenomanian to Santonian): Overlying the Mundeck Formation continuously or with a slight unconformity, it marks a more pronounced marine influence, characterized by marine clays, fine-grained sandstones, and local limestone intercalations [21].

3. MATERIALS AND METHODS

Geological field surveys conducted in the Mouanko area allowed for the collection of a representative suite of samples from the outcropping lithological formations (clays, sandstones, and conglomerates). A total of 17 rock and associated stream sediment samples (YOY and MET series) were selected for major element analysis, while a complementary set of samples (AMBA and AGS series) was chosen for trace element and Rare Earth Element (REE) analyses. Each sample underwent systematic drying, followed by primary crushing using a jaw crusher to obtain fragments smaller than 2 mm. A representative split was then pulverized in a carbon steel ring mill to achieve a fine, homogeneous grain size.

Major element concentrations were determined at the ALS Geochemistry laboratory in South Africa by X-ray fluorescence (XRF) spectrometry following the ME-XRF26 analytical protocol. An aliquot of approximately 0.7 g of pulverized sample was mixed with a lithium tetraborate and lithium metaborate ($\text{Li}_2\text{B}_4\text{O}_7$ - LiBO_2) flux, then fused at high temperature in a platinum crucible to obtain a glass disk. Loss on ignition (LOI 1000) was measured gravimetrically by calcination at 1000°C (Code OA-GR05x).

Trace element, base metal, and REE concentrations were quantified using the ALS Geochemistry ME-MS41 protocol. A 0.5 g aliquot of pulverized sediment was subjected to hot aqua regia (HNO_3 - HCl) digestion. The digested solution was then introduced into a combined Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES) system.

4. RESULTS

4.1. Major Elements

Tables 1 and 2 present the chemical analysis results of rocks and stream sediments from the Mouanko area. X-ray fluorescence (XRF) analysis reveals major compositional variations within the sedimentary formations of the Mouanko

region, allowing for the discrimination of three distinct geochemical poles:

- The Aluminous Pole (Clay-dominated facies): This group (YOY003, YOY005, MET005, MET006) is characterized by high Al_2O_3 concentrations ranging between 23.07% and 25.49%, associated with moderate SiO_2 contents (53.95% to 58.63%) and a high Loss on Ignition (LOI) varying from 12.49% to 13.70%. Alkaline and alkaline-earth oxides are strongly depleted ($< 0.1\%$).
- The Potassic-Alkaline Pole (Feldspathic sandstone facies): Represented by the MET007 to MET012 series, this pole displays high SiO_2 contents (60.93% to 63.57%) and notable Al_2O_3 concentrations (16.08% to 17.38%). It is fundamentally distinguished by a marked enrichment in alkalis, with K_2O ranging from 4.67% to 7.21% and Na_2O from 3.60% to 5.19%.
- The Iron-rich Pole (Indurated horizons / Ferruginized sandstones): Samples YOY004, MET001, and MET002 are drastically individualized by exceptional Fe_2O_3 concentrations, reaching 19.30%, 17.87%, and 19.74%, respectively.

Table 1
a Major Element Geochemistry (Part 1)

Sample (SAMPLE)	YOY001	YOY002	YOY003	YOY004	YOY005	MET001	MET002	MET003
Petrographic Facies	Sandy-clay	Sandy-clay	Pure clay	Ferruginous ss.	Pure clay	Ferruginous ss.	Ferruginous ss.	Silty clay
SiO_2 (%)	60.56	60.49	53.95	58.11	56.81	61.63	58.22	57.16
Al_2O_3 (%)	20.06	20.00	24.58	12.93	23.07	12.18	12.88	18.63
Fe_2O_3 (%)	4.70	4.63	7.88	19.30	7.36	17.87	19.74	12.75
K_2O (%)	2.48	2.48	0.04	0.05	0.04	0.05	0.05	0.06
Na_2O (%)	0.45	0.44	0.05	0.04	0.04	0.04	0.04	0.08
CaO (%)	0.28	0.28	< 0.01	0.07	< 0.01	0.06	0.07	0.02
TiO_2 (%)	1.82	1.83	0.38	0.38	0.36	0.34	0.38	0.66
LOI (%)	9.72	9.51	13.36	8.04	12.49	7.90	7.88	10.80
Total (%)	101.20	100.80	100.80	99.46	100.70	100.55	99.82	101.00
CIA	80.82	80.84	99.44	98.82	99.49	98.82	98.81	98.86
ICV	0.53	0.53	0.35	1.55	0.36	1.53	1.60	0.75
$\text{SiO}_2/\text{Al}_2\text{O}_3$	3.02	3.02	2.19	4.49	2.46	5.06	4.52	3.07

Table 1
b Major Element Geochemistry (Part 2)

Sample (SAMPLE)	MET004	MET005	MET006	MET007	MET008	MET009	MET010	MET011	MET012
Petrographic Facies	Silty clay	Pure clay	Pure clay	Potassic ss.	Basal arkose	Potassic ss.	Potassic ss.	Arkosic ss.	Arkosic ss.
SiO ₂ (%)	55.74	54.60	58.63	62.73	52.36	63.34	63.57	61.02	60.93
Al ₂ O ₃ (%)	19.03	25.49	23.52	17.38	16.08	17.00	17.22	16.22	16.24
Fe ₂ O ₃ (%)	13.11	4.69	3.87	3.17	9.11	2.98	2.72	4.55	4.11
K ₂ O (%)	0.06	0.07	0.07	7.21	4.67	6.85	7.01	7.07	7.07
Na ₂ O (%)	0.09	0.05	0.06	5.19	3.60	4.93	5.00	4.62	4.64
CaO (%)	0.02	0.03	0.02	1.42	6.01	1.48	1.30	2.00	1.92
TiO ₂ (%)	0.68	0.35	0.29	0.64	1.28	0.76	0.70	0.90	0.86
LOI (%)	11.20	13.70	13.25	0.48	0.73	0.54	0.36	0.39	0.49
Total (%)	100.80	99.31	100.00	100.50	100.75	99.88	99.65	100.30	99.60
CIA	98.83	99.29	99.19	52.43	55.42	53.09	52.90	54.39	54.58
ICV	0.77	0.21	0.20	1.15	1.64	1.09	1.02	1.25	1.21
SiO ₂ /Al ₂ O ₃	2.93	2.14	2.49	3.61	3.26	3.73	3.69	3.76	3.75

NB. For reasons of readability, minor elements measured by XRF such as MnO, P₂O₅, SO₃, SrO, BaO, and Cr₂O₃, whose contents all remain below 0.2%, have been omitted from this summary table but are retained in the original laboratory file (Supplementary Data).

4.2. Distribution of Trace Elements and Light Rare Earth Elements (LREE)

Multi-element analysis by ICP-MS spectrometry (Table 2) reveals a globally homogeneous distribution of trace elements and light rare earth elements within the Mouanko sedimentary series (AMBA and AGS series), underscoring a consistency in detrital supplies. Light Rare Earth Elements exhibit notable and stable concentrations, with Lanthanum (La) contents oscillating mainly between 36.60 ppm and 53.40 ppm, and Cerium (Ce) between 92.10 ppm and 137.00 ppm. Among the immobile trace elements with low migration potential, Zirconium (Zr) stands out as the major constituent, with sustained contents between 66.00 ppm and 79.00 ppm, systematically associated with significant concentrations of Thorium (Th: 6.20 ppm to 15.00 ppm) and Scandium (Sc: 6.90 ppm to 11.70 ppm). Compatible transition metals such as Vanadium (V) and Chromium (Cr) display moderate but steady values, stabilizing around 63.00–97.00 ppm and 53.00–74.00 ppm, respectively. Conversely, mobile alkaline-earth elements show contrasting behaviors: Barium (Ba) records high values ranging from 140.00 ppm to 330.00 ppm, while Strontium (Sr) remains heavily depleted, with contents not exceeding 45.90 ppm.

However, a major textural and chemical exception is recorded in samples AMBA006 and AMBA012. These two samples are individualized by a drastic collapse of their entire trace element signature, where Lanthanum (~ 9.5 ppm), Cerium (~ 24 ppm), Thorium (~ 3.8 ppm), and Zirconium (~ 19.5 ppm) drop to critical levels. This generalized negative anomaly reflects an intense grain-size sorting effect, characteristic of coarse-grained or pure quartzose facies that underwent pronounced geochemical leaching in a high-energy environment.

Table 2
Trace and Rare Earth Element Geochemistry

Sample	La (ppm)	Ce (ppm)	Th (ppm)	Sc (ppm)	Zr (ppm)	V (ppm)	Cr (ppm)	Ba (ppm)	Sr (ppm)
AMBA001	44.3	116.5	8.9	8.3	67	76	63	180	23.9
AMBA002	44.7	121.5	8.8	8.3	66	77	63	180	24.1
AMBA003	44.6	119.5	9.0	8.5	68	81	65	190	23.5
AMBA006	9.3	23.8	3.5	1.7	20	17	16	30	10.8
AMBA012	9.8	24.1	4.2	1.8	19	17	18	20	10.6
AMBA016	46.2	118.0	11.9	10.2	79	86	68	290	37.6
AMBA020	46.9	118.0	12.7	10.2	72	88	68	290	38.5
AGS001	47.1	120.5	15.0	10.8	73	89	70	300	40.2
AGS004	53.4	137.0	14.5	11.7	78	97	74	330	45.9
AGS006	48.7	120.0	13.9	10.9	75	88	70	310	43.2
AGS014	46.3	125.0	6.6	7.4	71	65	54	220	27.9
AGS020	42.5	115.0	6.2	6.9	67	63	53	220	25.4

NB. This summary table synthesizes the most discriminant geochemical tracers extracted from the source file (AMBA and AGS series), which are essential for supporting the provenance conclusions (Zr, Th, Sc, V, Cr) and the key Rare Earth Elements (La, Ce).

4.3. Sedimentary Facies and Chemical Classification

The quantitative chemical classification of the Alluvial Deposits in the Mouanko region was refined by plotting major oxide ratios onto the bivariate diagram of [38], which is based on the log-expression indices $\log(\text{SiO}_2/\text{Al}_2\text{O}_3)$ and $\log(\text{Fe}_2\text{O}_3/\text{K}_2\text{O})$. The graphical distribution of the samples reveals strong geochemical compartmentalization and validates the field-based lithological nomenclature (Fig. 2). The potassic-alkaline sandstone pole (samples MET007, MET009, MET010, MET011, and MET012) clusters homogeneously in the lower-left quadrant, strictly classifying as Arkoses/Wackes. Their silica maturity indices remain moderate ($\log(\text{SiO}_2/\text{Al}_2\text{O}_3)$ oscillating between 0.56 and 0.58), while their negative y-axis values (down to -0.41) reflect a $\text{Fe}_2\text{O}_3/\text{K}_2\text{O}$ ratio below unity, driven by the abundance of potassium. This signature confirms the preservation of detrital alkali feldspars within a chemically immature sandstone matrix. Conversely, the highly evolved clay horizons (YOY003, YOY005, MET005) as well as the indurated sandstone levels (YOY004, MET001, MET002) migrate drastically toward the top of the diagram, projecting into the exclusive fields of Fe-Shales (ferruginous clays) and Fe-Sandstones (ferruginous sandstones). This spectacular vertical shift, characterized by $\log(\text{Fe}_2\text{O}_3/\text{K}_2\text{O})$ indices rising between 1.74 and 2.60, is mathematically explained by the near-total leaching of potassium ($\text{K}_2\text{O} < 0.07\%$) combined with absolute iron enrichment (Fe_2O_3 up to 19.74%). Finally, sample MET006 positions itself at the boundary of the Shale field, reflecting an aluminous residual clay facies preserved from secondary ferruginous fluid circulations. The geochemical duality revealed by the [38] model thus demonstrates the coexistence, in the Mouanko sector, of arkosic sandstones preserving the upstream basement signature alongside fine or weathered sediments that underwent intense dynamics of hydrolysis and supergene ferruginization.

5. DISCUSSION

5.1. Intensity of Continental Chemical Weathering and Paleoclimatic Evolution

The graphical and molecular evaluation of the Alluvial Deposits from the Mouanko region highlights a cyclic and polyphase nature of the sedimentary infill, characterized by a highly contrasted, bimodal weathering trend (Figs. 3 & 4).

(i) The Highly Weathered Pole: Total Hydrolysis and Mineralogical Stability

In sharp contrast to the pristine facies, samples from the aluminous pole (YOY003, YOY005, MET005, MET006) and the iron-rich pole (YOY004, MET001, MET002) migrate drastically toward apex A of the ternary $\text{Al}_2\text{O}_3 - (\text{CaO}^* + \text{Na}_2\text{O}) - \text{K}_2\text{O}$ (A-CN-K) diagram. They cluster closely around the theoretical kaolinite pole (100% alumina). This signature is expressed by extreme chemical alteration indices (CIA > 98%, climbing beyond 98.8%) and particularly low Index of Compositional Variability (ICV) values (0.20 to 0.36), with the exception of iron-enriched levels. This combination of a maximum CIA and an ICV < 1 materializes an ultimate stage of mineralogical evolution (Fig. 3). At this stage, all original silicate minerals (feldspars, biotites) have been converted into highly stable residual clay phases. This spectacular vertical displacement reflects the collapse and complete leaching of labile mobile cations (Ca^{2+} , Na^+ , K^+) under aggressive supergene chemical decomposition. The alignment of these data points demonstrates that a major fraction of the sediments underwent total continental hydrolysis under a hot and super-humid paleoclimate. This intense leaching led to the exclusive neoformation of stable clay phases and insoluble hydroxides. This finding is in good agreement with the paleoclimatic models of [27] and [14] for the West African passive margin. Furthermore, the collapse of alkali contents in favor of a high Loss on Ignition (LOI) confirms the transition toward kaolinite-type clays documented by [26].

(ii) The Potassic-Alkaline Pole: Chemical Immaturity and Tectonic Control

In contrast, the group of potassic sandstones and arkoses (MET007 to MET012) projects tightly within the lower portion of the A-CN-K triangle, parallel to the Plagioclase–K-feldspar join line. Their geochemical signatures reveal low to moderate CIA indices (52.4% to 60%) and ICV values strictly greater than unity (1.02 to 1.25). This combination denotes a flagrant chemical immaturity and an absence of continental chemical weathering for this terrigenous sequence. The parent feldspars underwent minimal dissolution, confirming the deposition of first-generation arkosic sediments directly derived from the mechanical fragmentation and erosion of the adjacent Pan-African crystalline basement. This marked sedimentary duality between ultra-evolved sediments and immature deposits is explained by the works of [21] and [11]. These authors highlight the existence of tectonic reactivation phases along the West African margin. These tectonic pulses caused periodic rejuvenation of the basement topography and rapid mechanical erosion, temporarily interrupting prolonged phases of intense climate-driven hydrolysis.

5.2. Provenance of the Sediments

The absence of significant mineralization in base metals (Cu, Pb, Zn) and precious metals (Au, Ag) redirects interest toward the traceability of sedimentary sources. ICP-MS data reveal a marked enrichment in Light Rare Earth Elements (Ce ~ 120 ppm, La ~ 45 ppm) (Fig. 5), coupled with notable concentrations of Th (~ 9 ppm) and Zr (~ 65–80 ppm). Discriminant geochemical ratios—specifically a high Th/Sc ratio and a low Cr/Th ratio—point toward a felsic to intermediate crustal source. These signatures closely align with the model developed by [6] and [3, 24], indicating that the sediments were primarily derived from the dismantling of the Precambrian granito-gneissic basement complex.

5.3. Origin and Nature of Iron Concentrations

The Fe_2O_3 contents of samples YOY004, MET001, and MET002, oscillating between 17.87% and 19.74%, strongly suggest supergene enrichment. Given the intense alkali leaching observed, these horizons correspond to indurated lateritic facies (duricrusts or ferruginous sandstones) developed at the expense of the initial sedimentary formations. This mechanism is

entirely compatible with the observations of [9] and [20]. The absence of associated heavy metal anomalies (Ni, Cr, V) in the ICP-MS data definitively rules out any syn-sedimentary mafic magmatic influence, thereby validating a scenario of purely exogenic secondary concentration.

5.4. Depositional Environment and Industrial Valorization Potential

Signatures derived from trace element ratios (e.g., Ba/Sr ratios and the absence of negative U and V anomalies) show variations but broadly converge toward a globally oxic to suboxic depositional environment. The Mouanko sector fits into a transitional sedimentary system characterized by high hydrodynamic energy (fluvio-deltaic to estuarine), confirming the model proposed by [7]. The true economic opportunity lies in non-metallic substances: the high Al_2O_3 and LOI contents of the aluminous pole open up practical perspectives for the local industrial valorization of ceramic materials or construction eco-materials, in line with the recommendations of [25].

6. CONCLUSION

The multi-element lithogeochemical study of the Alluvial Deposits in the Mouanko region provides a comprehensive overview of their geological history and economic potential:

- (1). The application of the CIA highlights a bimodal evolution: the alumino-ferruginous pole displays extreme CIA values (> 98%), signing complete hydrolysis under a hot and super-humid paleoclimate, whereas the potassic-alkaline pole (CIA 55–60%) reflects chemical immaturity linked to rapid mechanical erosion.
- (2). Trace element and REE signatures demonstrate that the sediments were primarily derived from the dismantling of the Precambrian granito-gneissic basement complex within a passive margin setting.
- (3). The high Fe_2O_3 contents correspond to secondary supergene iron concentrations. Meanwhile, the aluminous horizons offer excellent potential for the local extraction and exploitation of ceramic and industrial materials.

Declarations

CRedit Authorship Contribution Statement

- **François Ndong Bidzang**: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.
- **Lawane Esaïe Sylèvre**: Writing – original draft, Methodology, Formal analysis, Data curation.
- **Justin Ndzie Mvondo**: Writing – original draft, Visualization, Data curation, Conceptualization.
- **Yvan Demonstel Ntomb**: Writing – review & editing.
- **Sobdjou Kemteu Cristel**: Validation, Project administration.

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Data Availability

The data supporting the results of this study are available on request from the corresponding author.

Ethics approval and consent to participate

Not applicable. This work did not describe experiments with animals, human subjects, or human tissue samples.

Competing interests

The authors declare no competing interests.

Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. Consent for publication Not applicable.

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Figures

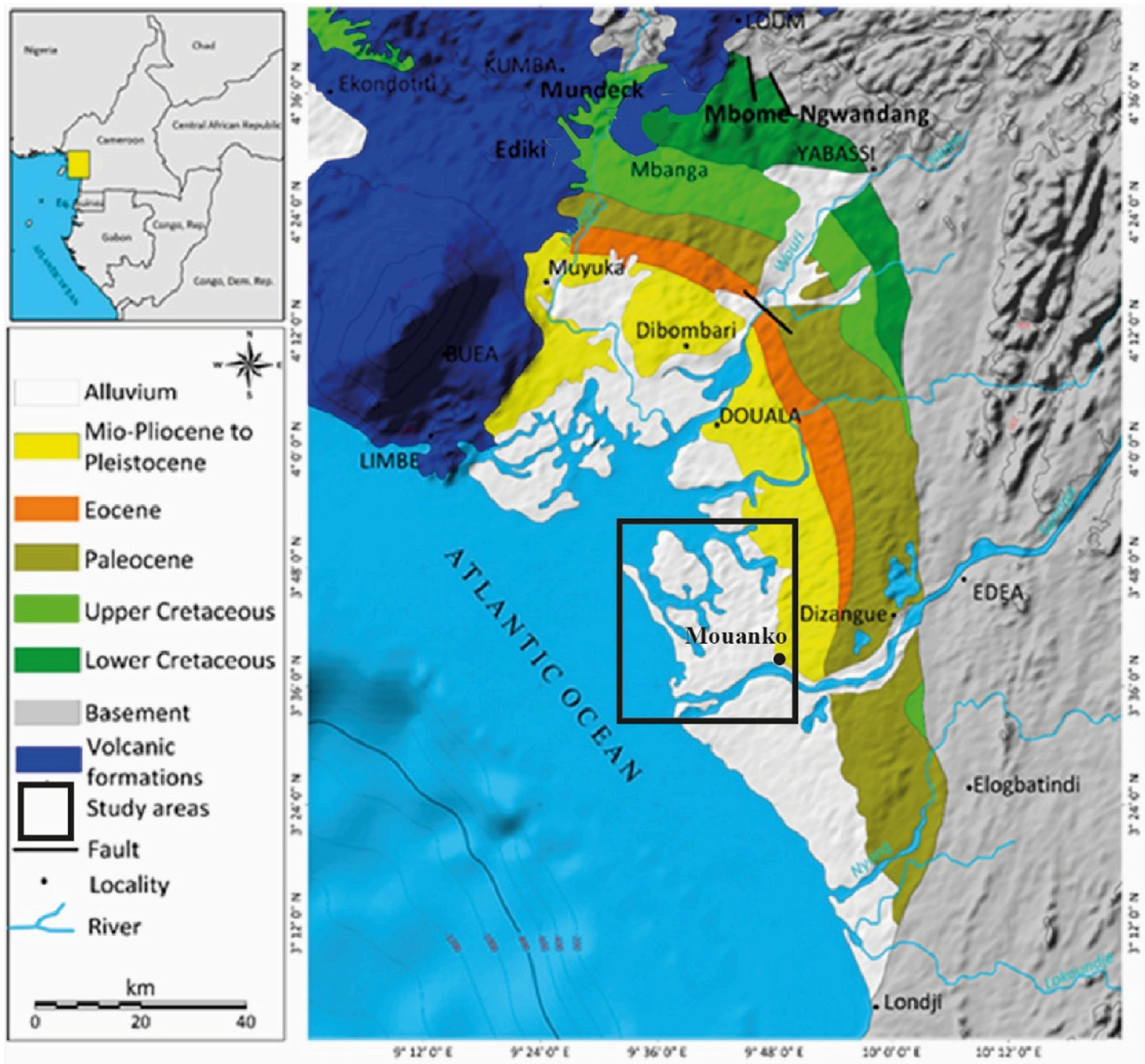


Figure 1

Geological map of the Douala Basin (Modified from [7, 34] with location of the studied areas.

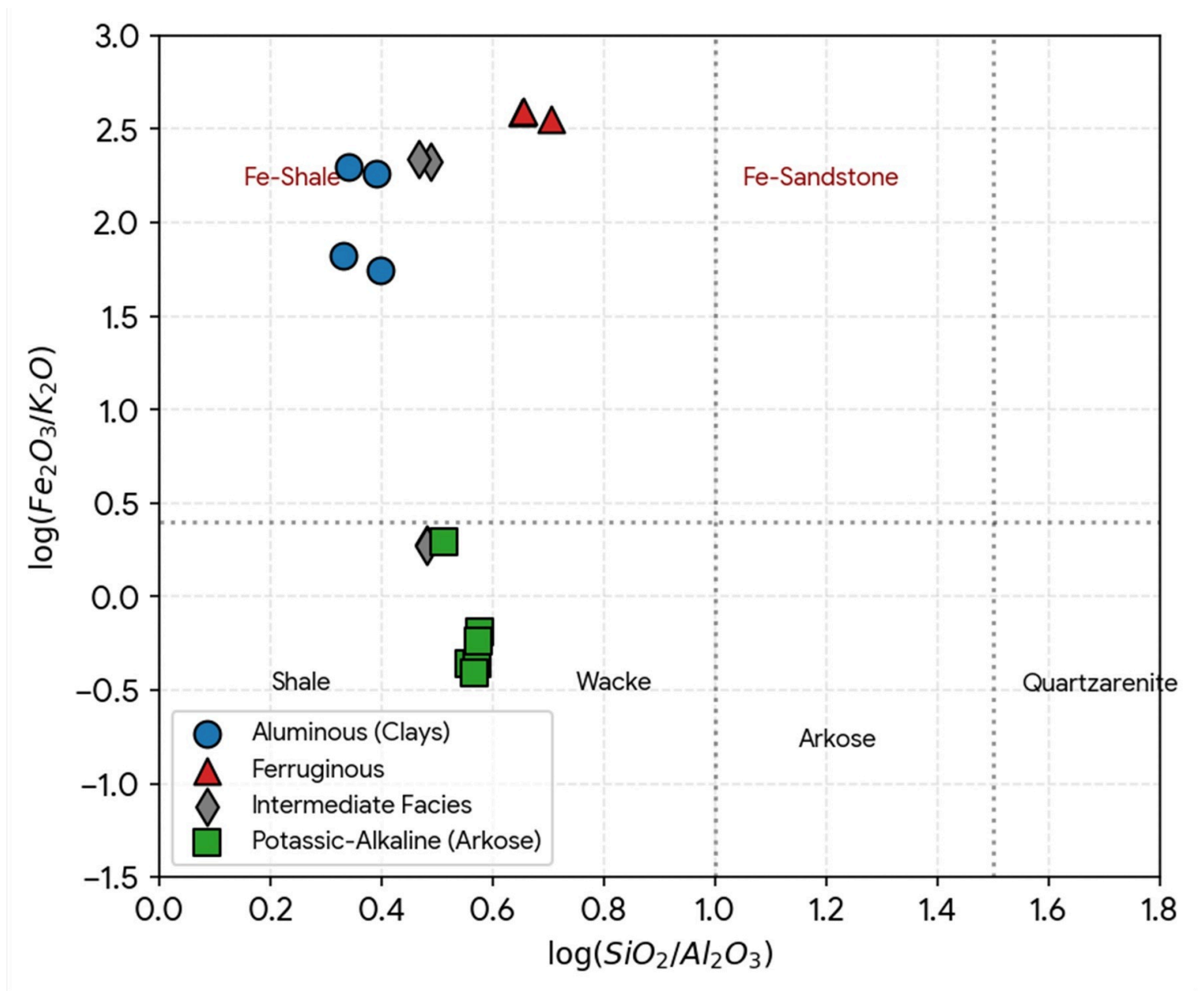


Figure 2

Geochemical classification of the Alluvial Deposits from the Mouanko region using the [38] diagram. Plots show a clear distinction between iron-rich sandstones/shales, aluminous residual clays, and potassic-alkaline arkoses

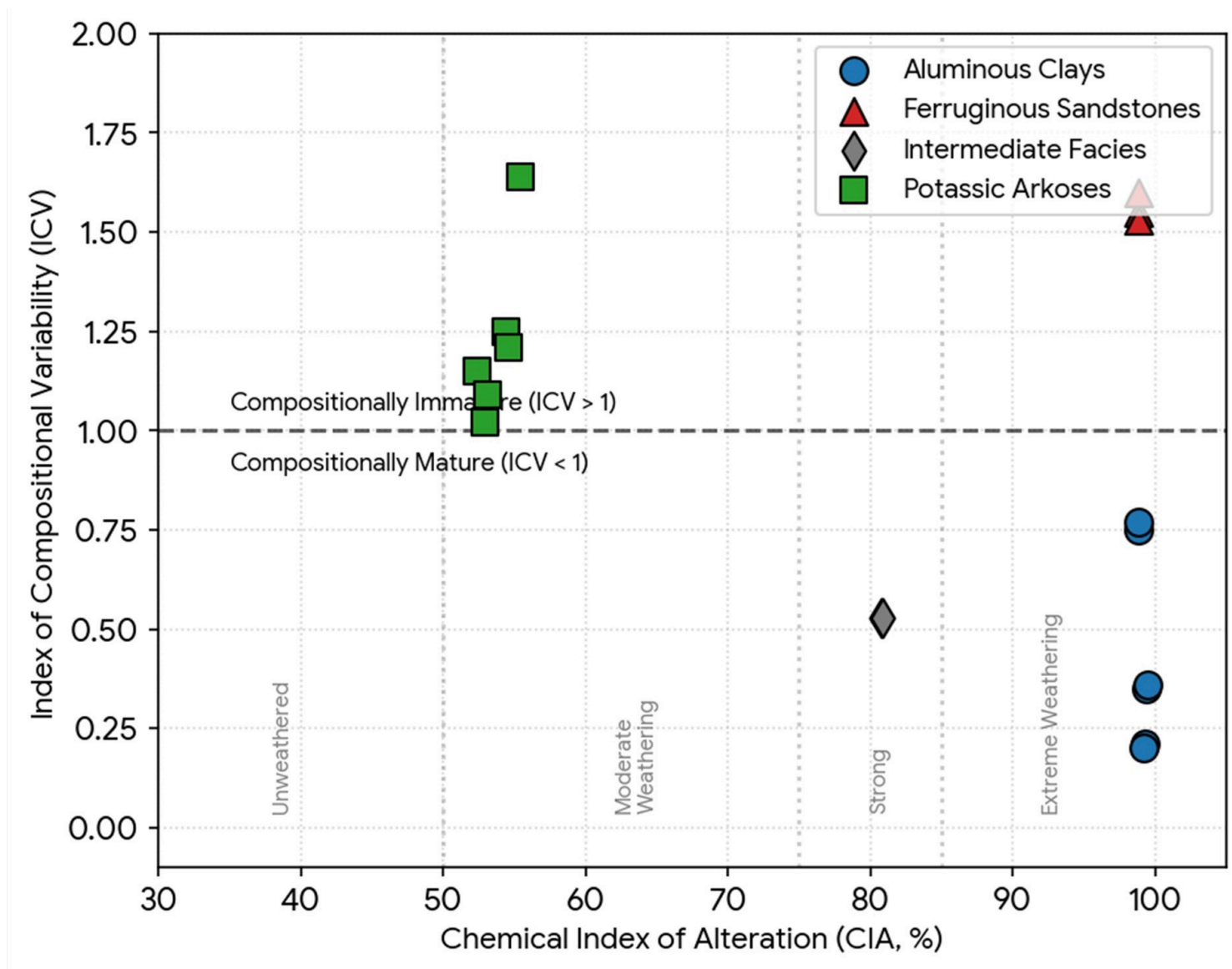


Figure 3

Maturity vs. Weathering plot (CIA vs. ICV) for Mouanko samples

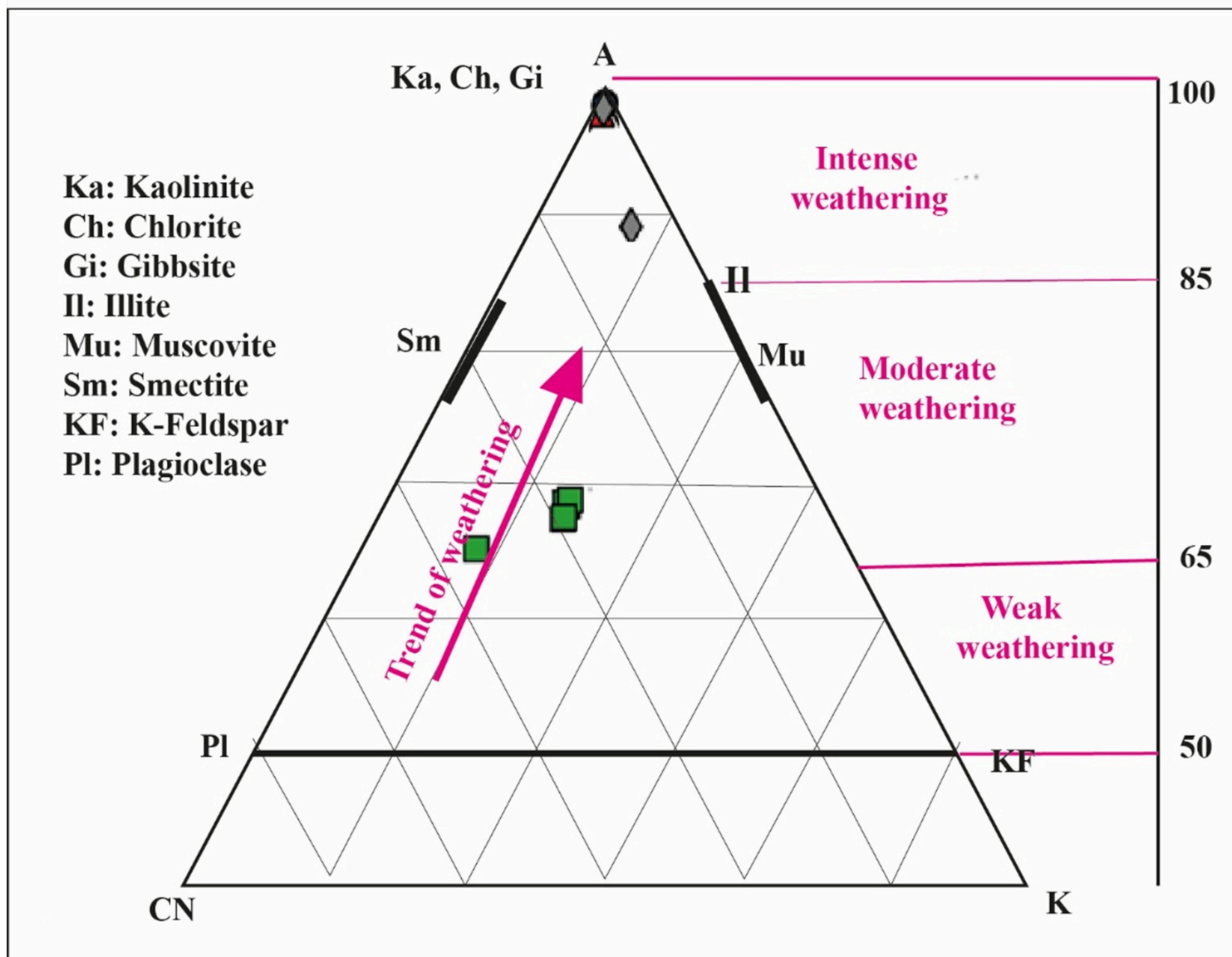


Figure 4

Ternary diagram A-CN-K [18] for Mouanko samples

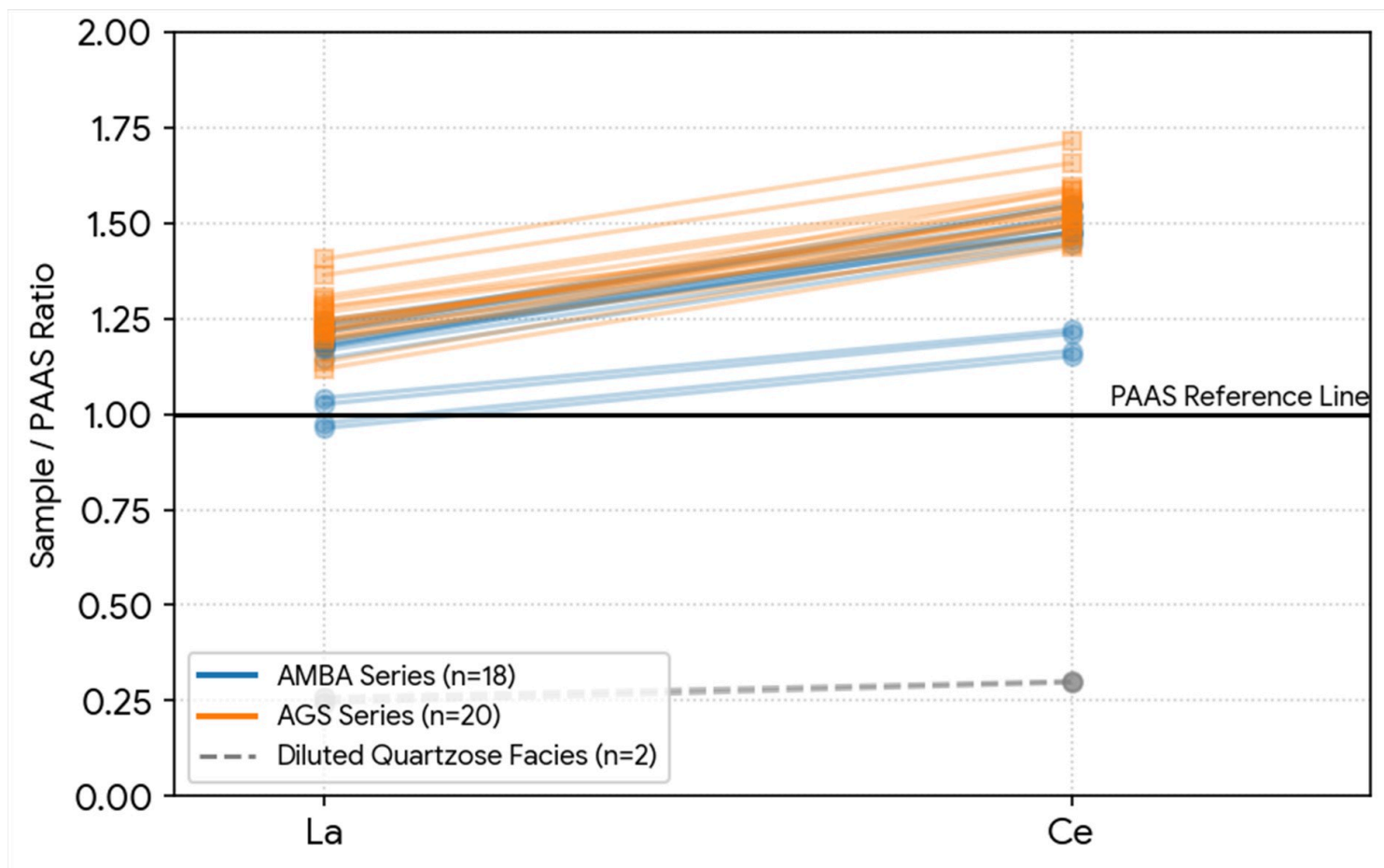


Figure 5

PAAS-normalized Rare Earth Element (REE) diagram for the La and Ce concentrations of the Mouanko Alluvial Deposits. The sub-horizontal profile highlights a mature felsic upper crustal source derived from the Precambrian crystalline basement.