ISSN: 2320-5407

International Journal of Advanced Research

Publisher's Name: Jana Publication and Research LLP

www.journalijar.com

REVIEWER'S REPORT

Manuscript No.: **IJAR- 59503**

Title: MULTIVARIATE ANALYSIS OF ABY LAGOON SEDIMENTS: IDENTIFICATION OF METAL CONTAMINATION SOURCES.

Recommendation:
Accept as it is .....
Accept after Minor revision.....
Accept after Major revision
Do not accept (*Reasons below*)

Rating	Excel.	Good	Fair	Poor
Originality		✓		
Techn. Quality		✓		
Clarity			✓	
Significance			✓	

Reviewer Name: **Dr. ANAPANA GOPAL**

Reviewer's Comment for Publication.

1. General Comments

The manuscript investigates the potential sources of trace metal contamination in sediments from the Aby Lagoon, specifically the Etuessika–Assinie Canal sector of Côte d'Ivoire. The study uses Pearson correlation analysis and principal component analysis (PCA) to examine relationships among ten trace elements and distinguish possible lithogenic, diagenetic, and anthropogenic influences.

The topic is relevant to environmental geochemistry, sediment quality assessment, and aquatic ecosystem management. The reported associations among arsenic, aluminium, and chromium, as well as mercury and zinc, provide a useful starting point for investigating possible contamination sources. The manuscript also addresses the environmental implications of lead and mercury contamination for aquatic ecosystems and surrounding communities.

However, several important methodological and interpretative concerns need to be addressed before the findings can be considered reliable. The most significant limitation is that the PCA is reportedly based on only four sampling stations or sediment cores and ten geochemical variables. This very small number of observations relative to the number of variables raises serious concerns about the stability and interpretability of the correlation matrix and principal components.

Furthermore, the attribution of particular components to artisanal gold mining and historical industrial contamination is stronger than the presented statistical evidence supports. PCA and correlation analysis can identify associations, but they cannot independently establish the origin, timing, or specific causes of metal contamination.

The authors should clarify the sampling structure, verify the statistical calculations, provide additional analytical quality-control information, and moderate claims regarding contamination sources and ecological risks. Overall, the manuscript addresses a relevant environmental issue, but substantial methodological and interpretative revisions are necessary.

ISSN: 2320-5407
International Journal of Advanced Research
Publisher's Name: Jana Publication and Research LLP
www.journalijar.com

REVIEWER'S REPORT

2. Content and Originality

The manuscript focuses on identifying potential sources of trace metal contamination in the Aby Lagoon using multivariate statistical techniques. The integration of geochemical measurements with PCA and Pearson correlation analysis is appropriate as an exploratory approach to understanding metal associations.

The reported Hg–Zn association is particularly noteworthy, as is the contrast between iron and several other elements. These patterns may help formulate hypotheses about natural geochemical processes and anthropogenic inputs.

Nevertheless, the manuscript's originality and contribution should be established more clearly in relation to previous studies of sediment contamination in Côte d'Ivoire, including research on the Aby, Ébrié, and Grand-Lahou lagoons.

The following issues require attention:

- The authors should identify the specific knowledge gap that this study addresses beyond previously published investigations of trace metal contamination in Ivorian lagoon sediments.
- The attribution of the Hg–Zn association to artisanal gold mining requires supporting evidence from mining activity data, site characteristics, or independent geochemical indicators.
- The interpretation of Pb as evidence of historical industrial discharges and former leaded-fuel use is plausible as a hypothesis but is not demonstrated by the reported PCA results alone.
- The manuscript discusses ecological risks and potential human-health implications, but the presented analyses do not include a detailed risk assessment, sediment-quality benchmark comparison, or direct measurements of exposure through water or aquatic organisms.
- The authors should distinguish clearly between findings directly supported by the present dataset and interpretations based on previous literature.

The study may offer useful preliminary evidence, but its contribution would be strengthened by a more precise statement of the research gap and more cautious claims about source identification.

3. Technical Quality

The technical quality of the manuscript requires substantial improvement, particularly in sampling design, statistical validity, reproducibility, and interpretation of the PCA results.

Minor technical concerns include:

1. Insufficient sample size for multivariate analysis: The manuscript states that PCA was conducted using four sampling stations and ten geochemical variables. With only four observations, the centred data matrix can have a rank of at most three. Consequently, the reported three non-zero principal components may simply reflect this mathematical limitation rather than three independently established contamination processes. The authors should clarify the actual number of independent observations used in the analysis.

2. Reliability of the correlation matrix: The reported correlations include exceptionally high coefficients, such as As–Al (\(r=0.988\)), Cr–Al (\(r=0.979\)), and Hg–Zn (\(r=0.969\)). With only four observations, these estimates are highly sensitive to individual values and should not be treated as robust evidence of common contamination sources. The correlation matrix should be recalculated using the verified dataset, with the sample size and limitations clearly reported.

ISSN: 2320-5407
International Journal of Advanced Research
Publisher's Name: Jana Publication and Research LLP
www.journalijar.com

REVIEWER'S REPORT

3. Inconsistency in PCA component selection: The manuscript reports eigenvalues of 6.10, 2.62, and 1.28 for PC1, PC2, and PC3, respectively, but subsequently states that only PC1 and PC2 satisfy the Kaiser criterion of eigenvalues greater than or equal to one. Since the reported PC3 eigenvalue is also above one, this statement is inconsistent and must be corrected.
4. Insufficient methodological detail: The authors should provide the original concentration data, sampling locations, sediment-depth intervals, sample preparation procedures, analytical detection limits, and quality-control information for the ICP-MS measurements. The statistical software packages and procedures used should also be documented sufficiently for reproducibility.
5. Interpretation of contamination sources: PCA and correlation analysis identify statistical associations rather than directly proving contamination sources. The attribution of Hg and Zn to artisanal gold mining and Pb to historical industrial emissions should be presented as provisional interpretations unless independently supported by site-specific evidence.
6. Data standardisation and compositional effects: The manuscript claims that Z-score standardisation resolves the closure effect associated with compositional data. This claim is not justified: standardisation adjusts the scale of variables but does not, by itself, resolve compositional-data constraints. The authors should explain the nature of their geochemical data and justify the selected preprocessing approach.
7. Ecological-risk assessment: The manuscript makes strong statements about ecological risk and threats to human health. However, the presented analysis does not establish exposure levels or quantify ecological risk using appropriate sediment-quality guidelines or risk indices. Such conclusions should be supported by additional evidence or moderated accordingly.
8. Figures and numerical consistency: The PCA figures, eigenvalue summaries, loading values, and contribution percentages should be checked against the original statistical output. The authors should ensure that the figures accurately represent the number of components retained and that all labels and captions are consistent with the text.
These issues are central to the validity of the study. The authors should first verify the sampling design and underlying data before revising the statistical interpretations.

4. Language and Presentation

The manuscript is generally understandable, and the scientific topic is clearly identifiable. However, the language and presentation require careful editing to improve precision, consistency, and readability.
The following corrections are recommended:

- Correct grammatical errors, punctuation problems, missing spaces, and inconsistent capitalisation throughout the manuscript.
- Standardise the terminology for principal component analysis, principal components, trace metal elements, and sampling stations.
- Use consistent abbreviations for principal components, avoiding the interchange of "PC" and "CP."
- Correct subsection numbering, particularly in the Materials and Methods and Results sections.
- Improve the clarity of statements that interpret statistical associations as evidence of specific contamination sources.

ISSN: 2320-5407
International Journal of Advanced Research
Publisher's Name: Jana Publication and Research LLP
www.journalijar.com

REVIEWER'S REPORT

- Standardise the formatting of scientific units, correlation coefficients, eigenvalues, percentages, and chemical symbols.
- Improve the readability of the correlation matrix and PCA plots, ensuring that all variable labels and station identifiers are legible.
- Avoid overly strong expressions such as "unequivocally demonstrates" and "confirms the direct impact" when the analysis supports only exploratory associations.

A comprehensive language and presentation revision is recommended after the scientific and statistical issues have been resolved.

5. Structure and Organization

The manuscript follows a conventional scientific structure, including an abstract, introduction, materials and methods, results, discussion, conclusion, acknowledgements, and references. The overall organisation is appropriate for a research article.

Nevertheless, several structural improvements are necessary:

- Abstract: Clearly state the actual number of independent samples, the principal analytical methods, the main findings, and the limitations of the source-attribution conclusions.
- Introduction: Define the research gap more explicitly and distinguish the present study from previous geochemical investigations of Ivorian lagoon sediments.
- Materials and Methods: Expand the description of sediment sampling, sample preparation, ICP-MS analysis, quality assurance, and the statistical workflow. Clarify whether the four cores represent the complete dataset or whether multiple independent samples were analysed.
- Results: Present the descriptive geochemical data before the correlation and PCA results. Report the number of observations used in each analysis and ensure that all tables and figures correspond to the verified calculations.
- Discussion: Separate the statistical findings from the proposed explanations for contamination sources. Discuss the limitations imposed by the small dataset and compare the results with previous studies critically.
- Environmental implications: Distinguish potential environmental concerns from risks that have been quantitatively assessed. Avoid making direct human-health claims without relevant exposure data.
- Conclusion: Summarise only the findings supported by the verified data and acknowledge the exploratory nature of the analysis.

The authors should also correct the numbering of the Results and Discussion sections and ensure that subsection headings follow a consistent hierarchy.

6. References and Citations

The manuscript includes literature relevant to environmental geochemistry, trace metal contamination, sediment quality, and artisanal gold mining. These references provide a useful foundation for discussing the potential sources and environmental significance of the measured elements.

However, the reference list and in-text citations require careful verification and standardisation.

The following points should be addressed:

1. Ensure that every in-text citation appears in the reference list and that every listed reference is cited in the manuscript.

ISSN: 2320-5407
International Journal of Advanced Research
Publisher's Name: Jana Publication and Research LLP
www.journalijar.com

REVIEWER'S REPORT

2. Verify the bibliographic details, publication years, journal titles, volume numbers, page ranges, and DOI information of all references.
3. Standardise author names, punctuation, and reference formatting according to the journal's requirements.
4. Provide direct and appropriate supporting references for claims concerning Hg–Zn associations in artisanal gold mining, the historical origin of Pb contamination, and the geochemical behaviour of Ni.
5. Ensure that citations supporting environmental and human-health implications are relevant to the specific claims being made.
6. Review recent references and confirm that their publication details and findings accurately support the statements attributed to them.
7. Strengthen the methodological references supporting PCA, Pearson correlation, and the treatment of geochemical data, particularly given the unusually small number of observations.

The reference list should be checked systematically to improve accuracy, traceability, and consistency.

7. Overall Recommendation

The manuscript addresses a relevant environmental issue and attempts to apply multivariate statistical methods to identify potential sources of trace metal contamination in Aby Lagoon sediments. The reported geochemical associations may provide preliminary information for further environmental investigations.

However, the current analysis has a fundamental limitation: the reported use of four observations to analyse ten variables raises serious concerns about the stability of the correlation matrix and the interpretability of the PCA. The inconsistent component-selection statement and the strong attribution of statistical patterns to specific contamination sources further weaken the conclusions.

The authors should verify the underlying dataset, clarify the sampling structure, reassess the statistical analysis, and substantially revise the interpretation of the results. The ecological-risk and human-health statements should also be limited to what the available evidence can support.

Recommendation: Minor revision is warranted only if the authors can provide a valid analytical basis for the study. If the dataset genuinely consists of only four independent observations, Minor claims about distinct contamination sources are not adequately supported by the current multivariate analysis and may require additional sampling or a substantially more limited interpretation.

8. Final Decision

Final Decision: Minor Revision

The manuscript should not be accepted in its current form. The authors must address the fundamental limitations in sample size, statistical interpretation, component selection, and contamination-source attribution before the scientific validity of the findings can be adequately assessed. If these concerns cannot be resolved using the existing data, additional sampling and reanalysis may be necessary.