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REVIEWER'S REPORT

Manuscript No.: IJAR- 58977

Title: QUATERNARY VOLCANIC ERUPTION TOBA ASH FALL ITS IMPACTS ON ENVIRONMENT OF LATE PLEISTOCENE HOMININES IN INDIAN SUBCONTINENT WITH SPECIAL REFERENCE TO NARMADA VALLEY. INDIA.

Recommendation:
Accept as it is .....
Accept after Major revision.....
Accept after Minor 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.

General Comments

The manuscript addresses an important and interdisciplinary topic concerning the **74 ka Toba eruption, Youngest Toba Tuff (YTT), Late Pleistocene environmental change, archaeological evidence, and hominine populations in the Narmada Valley**. The manuscript attempts to synthesize geological, sedimentological, tephrochronological, palaeoenvironmental, palaeontological, and archaeological information. The identification and discussion of two ash horizons, NAB-I and NAB-II, and their relationship with Quaternary deposits of the Narmada Valley provide potentially useful regional context. The manuscript also discusses the wider distribution of YTT across the Indian subcontinent.

However, in its present form, the manuscript requires substantial revision before it can be considered for publication**.** The principal concerns relate to the lack of a clearly defined research methodology, insufficient presentation of original analytical data, repetition of large sections, inadequate separation between previously published information and the authors' own observations, and several conclusions that are considerably stronger than the evidence presented.

In particular, the manuscript repeatedly interprets the association between Toba ash and hominine fossils as evidence for **mass extinction, migration, and severe ecological disruption**, although the presented stratigraphic association alone does

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not demonstrate a direct causal relationship. The manuscript itself acknowledges that the fossil evidence from India is limited and does not adequately establish which hominine populations were present at approximately 74 ka.

1. Content and Originality

The subject is scientifically significant and has potential value because the Narmada Valley contains important Quaternary sedimentary, archaeological, palaeontological, and tephra records.

The manuscript provides useful information on:

- occurrence of volcanic ash in the Narmada Valley;
- NAB-I and NAB-II ash horizons;
- their stratigraphic positions;
- morphology of volcanic glass/shards;
- comparison with YTT deposits from other Indian river valleys;
- association with Quaternary sedimentary formations;
- possible palaeoenvironmental implications;
- relationship between Toba ash and Late Pleistocene hominines.

However, the manuscript currently reads largely as a **compilation/review of previously published information**, rather than a clearly defined original research article. The authors should clearly state:

1. What is new in the present study?
2. Which observations are based on new fieldwork?
3. Which analytical results were generated by the authors?
4. Which information is reproduced or synthesized from previous publications?
5. What specific scientific hypothesis is being tested?

The statement that the study is the "first attempt" to collect and condense information should be reconsidered and supported appropriately.

2. Minor Concern: Research Methodology

A Minor weakness is the insufficient description of the methodology.

The manuscript refers to studies of:

- glass-shard morphology;
- quartz-grain morphology;
- lithic fragments;
- ash-bed characteristics;
- chemical composition;

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- sedimentological characteristics;
- stratigraphic relationships;
- archaeological and palaeontological associations.

However, the manuscript does not adequately explain the **sampling strategy, analytical procedures, instruments, sample numbers, laboratory methods, analytical uncertainties, or statistical treatment**.

For example, the manuscript states that NAB-I and NAB-II have diagnostic chemical composition and distinctive morphological characteristics, but the relevant analytical dataset is not adequately presented.

The revised manuscript should include a dedicated **Materials and Methods** section describing:

- exact sampling localities;
- geographic coordinates;
- number of ash samples;
- number of samples analyzed;
- stratigraphic positions of samples;
- sample preparation procedures;
- petrographic/microscopic methods;
- SEM/EDS or other analytical techniques, if used;
- major- and trace-element analytical methods, if used;
- analytical precision and standards;
- criteria used for identifying YTT;
- methods used for quartz-grain morphology;
- procedures used for stratigraphic correlation;
- dating methods and associated uncertainties.

Without these details, the reproducibility of the study is limited.

3. Identification of Toba Ash / YTT

The manuscript strongly identifies the Narmada ash deposits as products of the Toba eruption. This interpretation needs to be demonstrated more systematically.

The manuscript refers to similarities in glass-shard morphology and previous geochemical studies identifying Indian tephras as YTT.

However, the present manuscript should clearly distinguish:

A. Evidence generated in the present study

from

B. Evidence reported by previous researchers.

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If the identification of NAB-I and NAB-II as YTT is based primarily on earlier geochemical work, the authors should state this explicitly rather than presenting the identification as entirely new.

If original geochemical data are available, they should be presented in a proper table, together with appropriate plots and comparison with established YTT compositions.

4. Stratigraphic Interpretation

The discussion of the two ash horizons is potentially valuable. NAB-I is associated with the Hathnora/boulder conglomerate succession, while NAB-II is associated with younger clay-silt deposits. The manuscript describes five layers, L1–L5, distributed between the two ash horizons.

However, the stratigraphic interpretation needs considerable clarification.

The manuscript should provide a **clear composite stratigraphic column** showing:

- basement;
- glacial/fluvio-glacial deposits;
- Hathnora/Boulder Conglomerate Formation;
- Sohagpur Formation;
- Shahganj Formation;
- younger fluvial deposits;
- NAB-I;
- NAB-II;
- L1–L5;
- fossil-bearing horizons;
- archaeological horizons;
- depth/elevation;
- available chronological constraints.

At present, the text repeatedly gives different depths and elevations for the ash horizons and fossil occurrences. These should be checked carefully and presented consistently.

The manuscript also interprets the two ash horizons as evidence for two phases of ash deposition and a significant time gap. However, the presence of two stratigraphic ash horizons does **not by itself demonstrate two separate eruptive phases of Toba**. The possibility of reworking, redeposition, sedimentary hiatuses, or multiple depositional pulses needs to be considered.

5. Palaeoenvironmental Interpretation

The manuscript proposes that the Toba eruption caused major environmental and climatic deterioration in the Narmada Valley. It describes volcanic dust, ash, gases, atmospheric contamination, darkness, and ecological disruption.

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The environmental interpretation is interesting, but several statements are too definitive.

For example, the manuscript states that the atmosphere was contaminated and that the eruption caused prolonged darkness and major environmental effects. These interpretations require independent palaeoclimatic evidence.

The authors should distinguish between:

- **direct evidence** from sedimentology and tephra;
- **inference** based on volcanic-climate models;
- **interpretation** based on previous literature;
- **speculation/hypothesis** regarding local environmental consequences.

Evidence such as ash thickness, sedimentological changes, palaeosols, pollen, phytoliths, stable isotopes, faunal turnover, or other independent environmental proxies would substantially strengthen the argument.

6. Minor Concern: Toba Eruption and Hominine Extinction

This is the most important conceptual issue in the manuscript.

The manuscript repeatedly concludes that the Toba eruption caused severe impacts and even **"mass extinction" of hominines** in the Narmada Valley and Indian subcontinent.

However, the evidence presented does not sufficiently demonstrate this causal relationship.

The manuscript itself states that fossil evidence is limited and that the available evidence cannot establish which hominine species occupied India at approximately 74 ka.

Therefore, the following claims should be substantially moderated:

- "mass extinction";
- "confirmed" impact on hominines;
- forced migration from Narmada to Bhimbetka;
- survival specifically because of Toba-related environmental pressure;
- direct demographic collapse caused by the eruption.

The association of a fossil at one stratigraphic level with an ash bed does not establish that the organism was killed by the eruption or that its population underwent extinction.

A more scientifically appropriate formulation would be:

"The stratigraphic association of the Toba ash horizons with Late Pleistocene archaeological and palaeontological records provides an important framework for

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evaluating the possible environmental effects of the eruption on hominine populations in the Narmada Valley."

This would preserve the significance of the observation without exceeding the evidence.

7. Migration to Bhimbetka

The manuscript proposes that hominines living in the Central Narmada Valley migrated to Bhimbetka following the eruption and environmental deterioration.

This is an interesting hypothesis, but the manuscript does not provide sufficient chronological and archaeological evidence to demonstrate this migration.

The authors should provide:

- secure dates for the relevant archaeological assemblages;
- stratigraphic relationships between ash and archaeological material;
- evidence for occupation immediately before and after the eruption;
- evidence for population displacement;
- independent archaeological evidence supporting movement from Narmada to Bhimbetka.

In the absence of such evidence, this should be presented as a **possible hypothesis rather than an established conclusion**.

8. Interpretation of Two Ash Horizons

The manuscript interprets NAB-I and NAB-II as two cyclic ash-fall events and suggests that the interval between them reflects a significant environmental/climatic change.

This requires further evaluation.

The authors should clarify:

- whether both horizons have been independently geochemically fingerprinted;
- whether both are unequivocally YTT;
- whether the two horizons represent separate eruptive pulses or sedimentary reworking;
- their absolute or relative ages;
- the duration represented by the intervening sediments;
- whether the vertical separation corresponds to a known chronological interval.

The manuscript should avoid implying that two ash horizons necessarily represent two separate eruptions unless supported by geochemical and chronological evidence.

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9. Geochemical and Petrographic Evidence

The manuscript makes several statements concerning glass-shard morphology, pumice, cuspate shards, rhyolitic magma, silica volcanism, and temperature.

These observations need to be supported by actual analytical data.

The revised manuscript should include, where available:

- photomicrographs of representative glass shards;
- SEM images;
- EDS spectra;
- major-element composition;
- trace-element composition;
- comparison with established Toba/YTT reference material;
- discrimination plots;
- sample numbers and localities.

If these data were published previously, the authors should cite the original studies and clearly identify the present contribution.

10. Discussion of Climate

The manuscript relies heavily on the concept of a Toba-induced "volcanic winter" and compares Toba with Tambora and Pinatubo.

This provides useful background, but the discussion should be more balanced.

The manuscript should recognize that the magnitude and duration of climatic effects from the Toba eruption remain a subject of scientific debate. The authors should avoid presenting one climatic scenario as conclusively demonstrated.

The discussion would be stronger if it separated:

1. atmospheric effects expected from a super-eruption;
2. regional tephra deposition;
3. evidence for local environmental change;
4. evidence for regional climate change;
5. evidence for global climate change;
6. evidence for demographic consequences.

11. Structure and Organization

The manuscript is excessively repetitive.

Several paragraphs and even substantial sections repeat almost identical descriptions of:

- NAB-I;

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- NAB-II;
- Hathnora Formation;
- Homo erectus;
- Toba ash;
- ash morphology;
- environmental impact;
- migration;
- climate deterioration.

For example, descriptions of the two ash horizons and their association with the Narmada sedimentary sequence recur multiple times throughout the manuscript.

The manuscript should be substantially reorganized into a logical scientific structure:

Suggested structure

1. **Introduction**
2. **Objectives**
3. **Geological and Archaeological Setting**
4. **Materials and Methods**
5. **Results**
    - Stratigraphy
    - Ash-bed characteristics
    - Petrography
    - Geochemistry
    - Archaeological/palaeontological association
6. **Discussion**
    - Identification of YTT
    - Stratigraphic significance
    - Environmental implications
    - Hominine implications
    - Regional comparison
7. **Limitations**
8. **Conclusions**

This would significantly improve readability.

12. Figures and Tables

The manuscript refers to figures and tables, including Figure 1, Figure 3 and Table 2, but the presentation needs substantial improvement.

The revised manuscript should include:

- a high-quality location map;
- geological map of the Narmada Valley;
- distribution map of YTT in India;
- detailed stratigraphic column of the Narmada Valley;

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- enlarged profiles showing NAB-I and NAB-II;
- photographs of ash horizons;
- microscopic/SEM images of glass shards;
- geochemical comparison plots;
- chronological framework;
- archaeological and palaeontological horizons.

A single integrated stratigraphic figure showing **ash horizons + fossil horizons + archaeological horizons + formations + ages** would be particularly valuable.

13. References and Citations

The manuscript contains many relevant references, including studies on Toba ash, Narmada Quaternary deposits, palaeontology, archaeology and palaeoenvironmental interpretation.

However, the reference section requires careful editorial checking.

The authors should verify:

- author names;
- publication years;
- journal titles;
- volume and issue numbers;
- page ranges;
- punctuation;
- consistency of citation style;
- DOI information where required;
- correspondence between in-text citations and reference list.

Several citations appear inconsistently formatted, and some author names and references appear to contain typographical or transcription errors.

14. Language and Editorial Quality

The manuscript requires **extensive English-language editing**.

There are numerous grammatical and typographical problems, including:

- incorrect verb forms;
- missing articles;
- incorrect pluralization;
- missing spaces;
- joined words;
- inconsistent capitalization;
- inconsistent terminology;
- incorrect spelling of scientific terms;
- inconsistent use of "ash bed," "ash-bed," and "volcanic ash";

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- incorrect or inconsistent use of "Homo erectus," "hominine," "Pleistocene," etc.;
- punctuation problems;
- incomplete sentences.

Examples include expressions such as "it have led," "had a impact," "scientist," "forma canopy," "Aeolian agonies," and several other constructions throughout the manuscript.

Professional scientific English editing is strongly recommended before resubmission.

Strengths of the Manuscript

Despite the above concerns, the manuscript has several strengths:

1. **Important research topic** involving the Toba super-eruption and Late Pleistocene environmental change.
2. **Strong regional focus** on the Narmada Valley.
3. Discussion of **two ash horizons (NAB-I and NAB-II)** is potentially valuable.
4. Integrates **geology, tephrochronology, palaeontology and archaeology**.
5. Provides useful compilation of previous work on YTT distribution in India.
6. Attempts to address an important and controversial question concerning the relationship between Toba eruption and hominine populations.
7. The Narmada Valley provides an appropriate geological and archaeological context for this type of study.

Minor Issues to Be Addressed Before Publication

Overall Recommendation

The manuscript addresses a **highly relevant and potentially publishable interdisciplinary problem**, and the Narmada Valley material could provide an important contribution to discussions of the environmental significance of the Toba eruption.

Recommendation: Minor Revision

The manuscript should be reconsidered after substantial revision addressing the methodological deficiencies, evidence for YTT identification, stratigraphic framework, hominine interpretation, figures/tables, references, and language quality.

Final Decision: Minor Revision