

Genetic diversity of *Macrotermes* termites in Namibia: an update six decades after the National Survey of Isoptera of Southern Africa

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Environmental context in Namibia



- Wide diversity of ecosystems

Biomes

- Tree & Shrub Savanna
- Nama Karoo
- Namib Desert
- Succulent Karoo
- Lakes & Saltpans

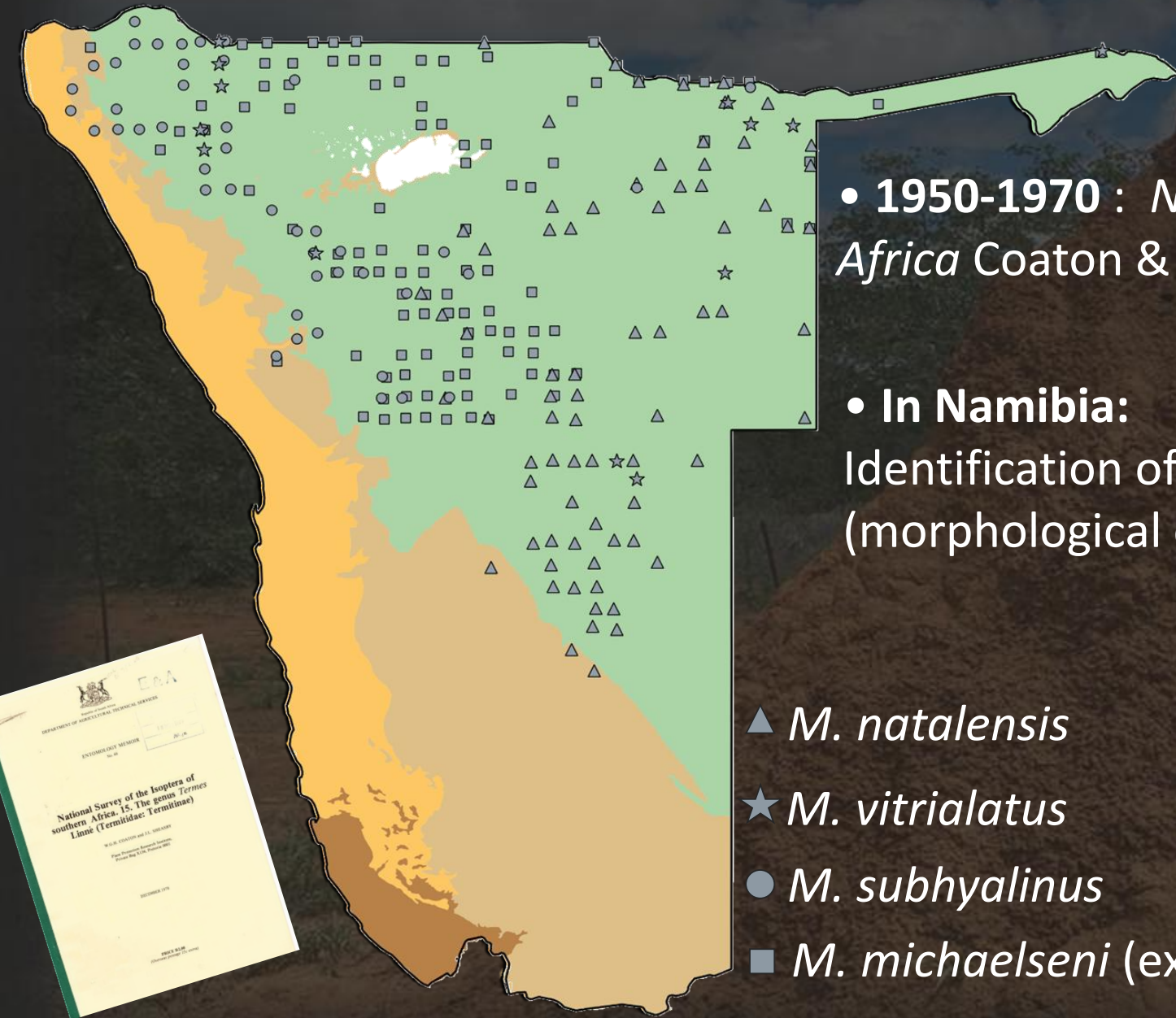
- ~20% of the fauna is scientifically documented
- Insect diversity in Namibia remains under-studied

Macrotermes (Termitidae: Macrotermitinae) termites



- Cultivate a symbiotic fungus (*Termitomyces*) that degrades plant matter
- Key ecosystem engineers:
 - decompose organic matter
 - enhance bioturbation
 - improve soil water infiltration
- Consumed insects (Van Huis 2017)
- 58 species, 18 in Africa (Krishna et al. 2013)

History of the study of termites in Southern Africa



- **1950-1970** : *National Survey of the Isoptera of Southern Africa* Coaton & Sheasby (1972) → **35,000 samples**

- **In Namibia:**

Identification of **4 species of *Macrotermes*** in Namibia (morphological criteria)

- ▲ *M. natalensis*

- ★ *M. vitrialatus*

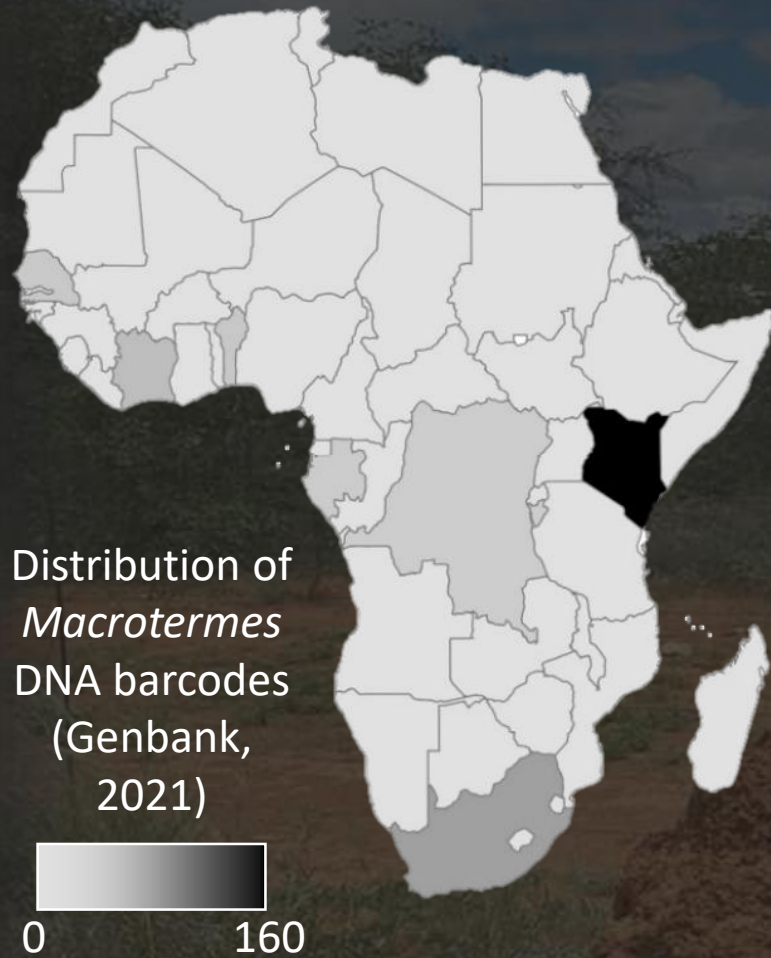
- *M. subhyalinus*

- *M. michaelsoni* (ex *M. mossambicus*)



Cryptic diversity and genetic overlap in *Macrotermes*

- Morphological identifications are limited
- Lack of genetic data: no DNA sequence data for *Macrotermes* in Namibia.
- Recent studies reveal **cryptic diversity** among *Macrotermes* across Africa



insects



Article

Overview of the Genetic Diversity of African *Macrotermes* (Termitidae: Macrotermitinae) and Implications for Taxonomy, Ecology and Food Science

Bronwyn Egan ¹, Zwannda Nethavhani ² and Barbara van Asch ^{2,*}

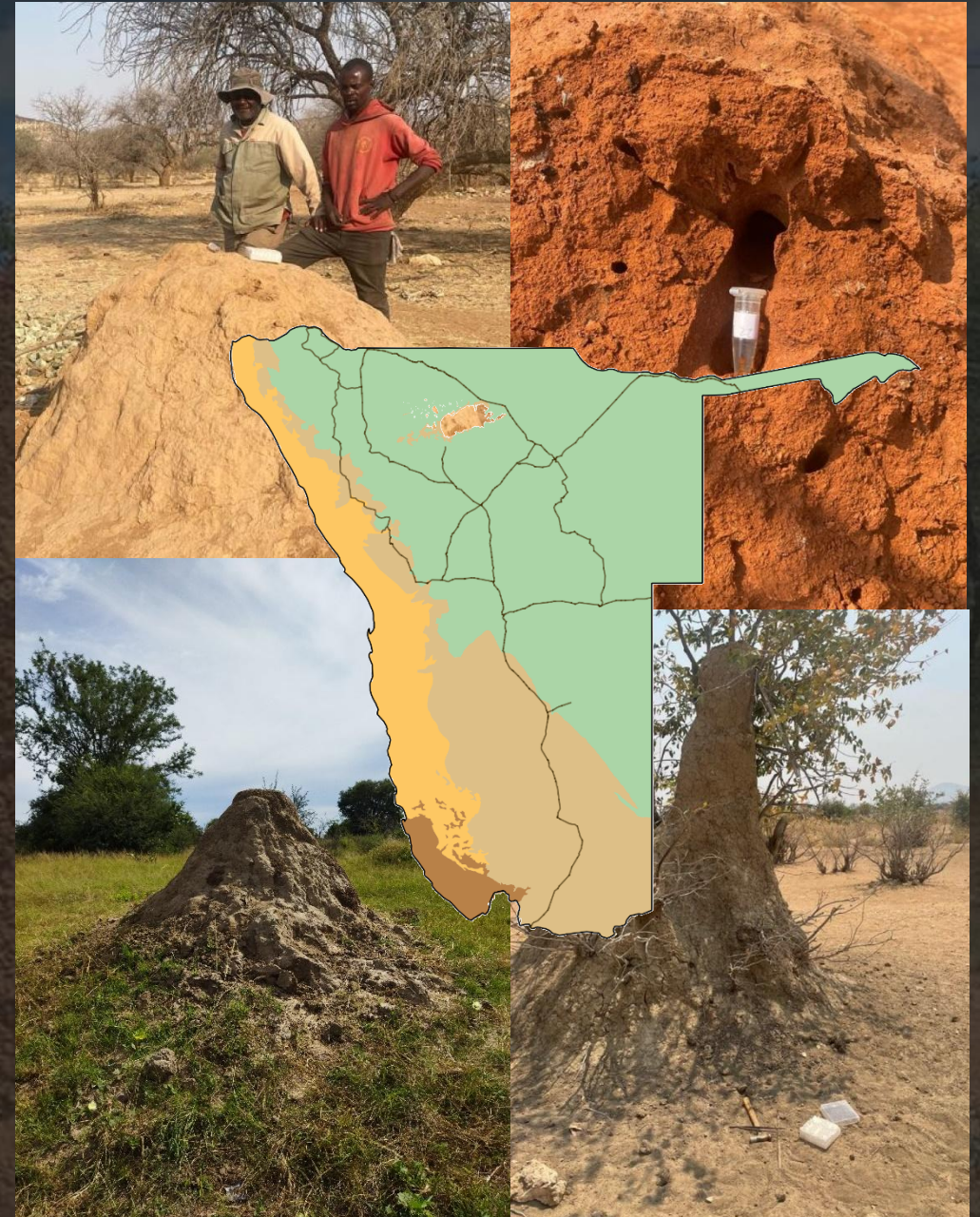
→ Namibia: a case study

1st objective: genetic diversity

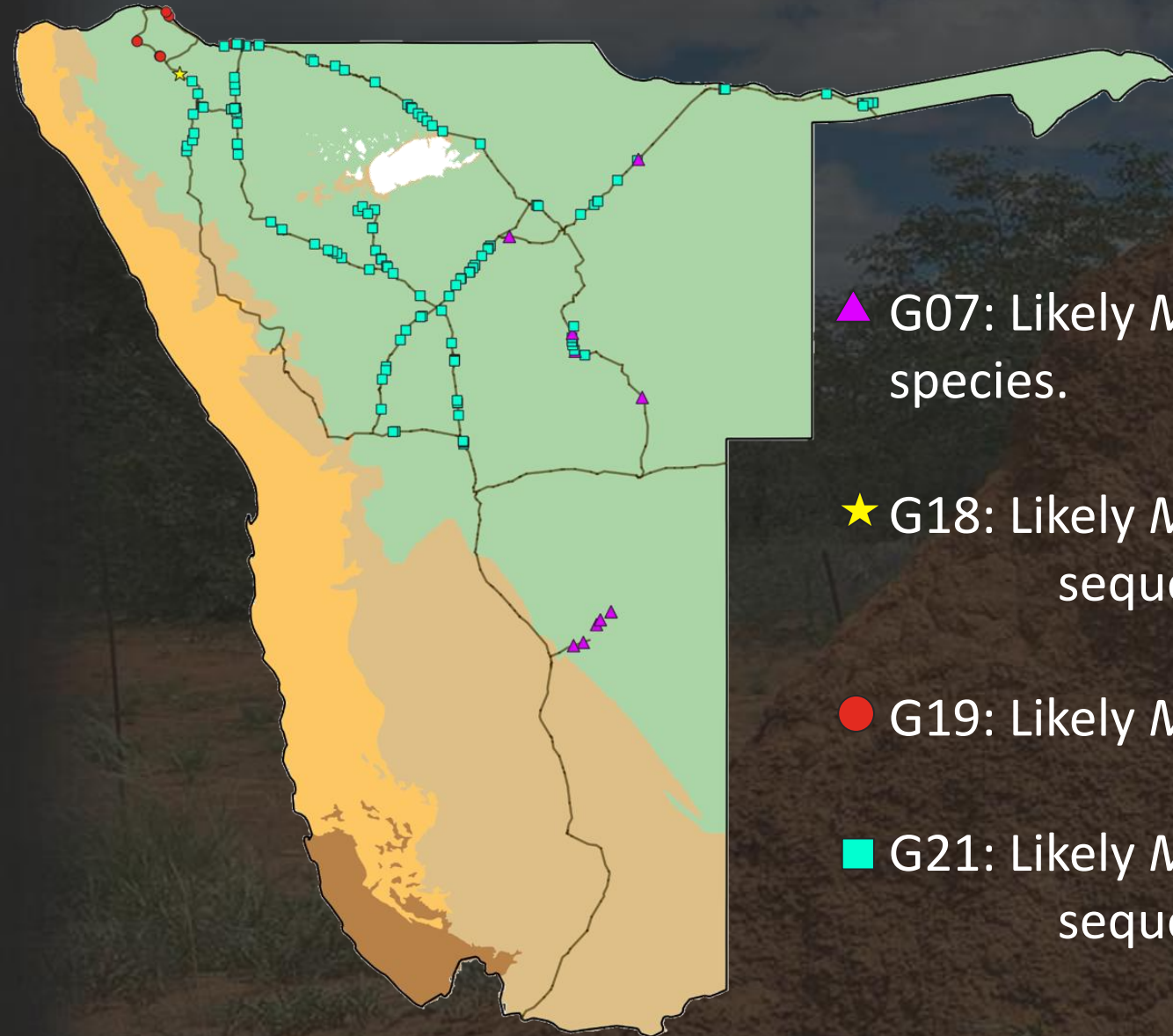
Re-examine the diversity of *Macrotermes* in Namibia using modern genetic methods

Methods:

- Sampling campaign from March 2021 to April 2024
- 176 *Macrotermes* termite mound samples across Namibia (~7,400 km of roads)
- DNA extraction and phylogenetic analysis using new COI barcoding sequences and public database data



Genetic diversity: phylogeny and group delimitation



4 genetic groups

(based on mitogenomes and barcoding)

- ▲ G07: Likely *M. natalensis* – possible presence of multiple species.
- ★ G18: Likely *M. vitrialatus* – distinct from Burundi sequences.
- G19: Likely *M. subhyalinus* – unresolved taxonomic issues
- G21: Likely *M. michaelsoni* – distinct from Kenyan sequences.

Genetic diversity: unresolved *M. subhyalinus* taxonomic issues



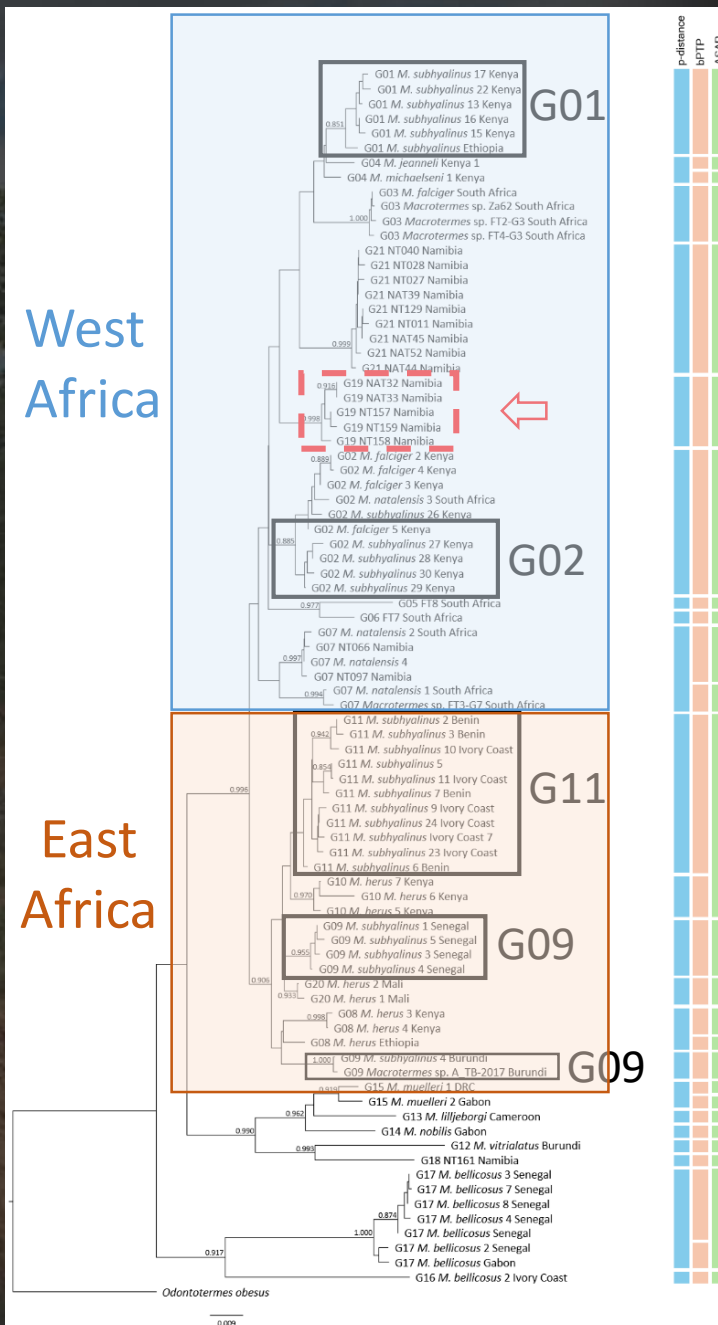
- G19 likely *M. subhyalinus* described in Namibia
- But not linked to known clusters.
- Strong East-West genetic divergence (Brandl et al. 2007, Marten et al., 2009)
- Distinct evolutionary history → support distinct genetic units.

Genetic groups (2021-2023)

● G19

Historical records (1964-1967)

● *M. subhyalinus*



West Africa

East Africa

G01

G02

G11

G09

G09

G17



2nd objective: environmental preferences

Explore the links between genetic groups / species and environmental variables

Methods:

- Environmental data: collected measurements from both historical and recent sampling periods for each sampling point

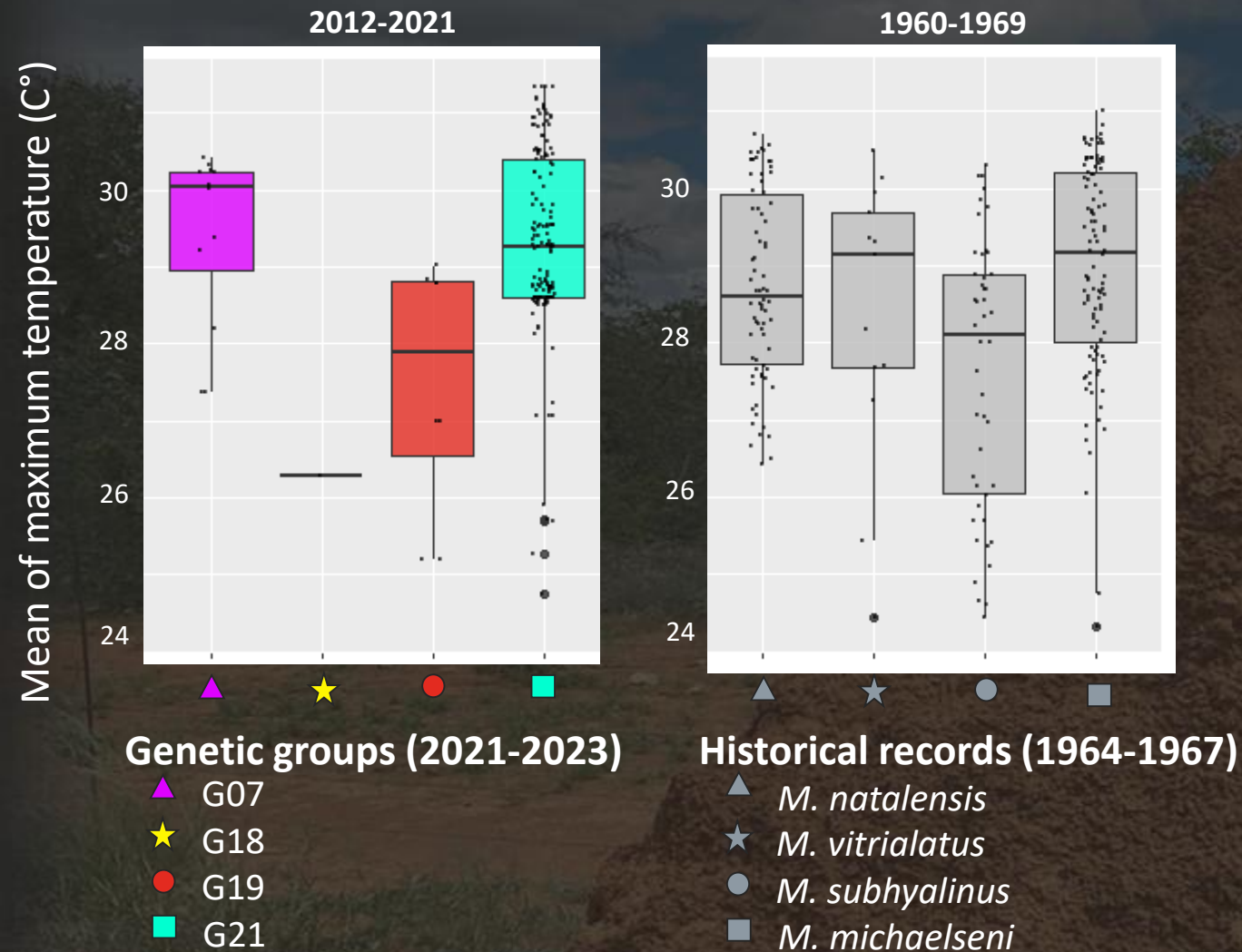
- Statistical analyses:

Kruskal-Wallis and Wilcoxon tests to identify significant differences between groups

Multinomial regression to assess the combined effect of environmental variables on group membership.



Environmental preferences: temperatures



- Temperature: associated with the distribution of species / genetic groups

Kruskal-Wallis test:

Significant differences of environmental variable found in several cases (Chi² = 48.15 to 103.86, p < 0.001).

Multinomial regression analysis:

Many associations between environment and group/species were negative (z = -16.05 to -2.21, p < 0.05).

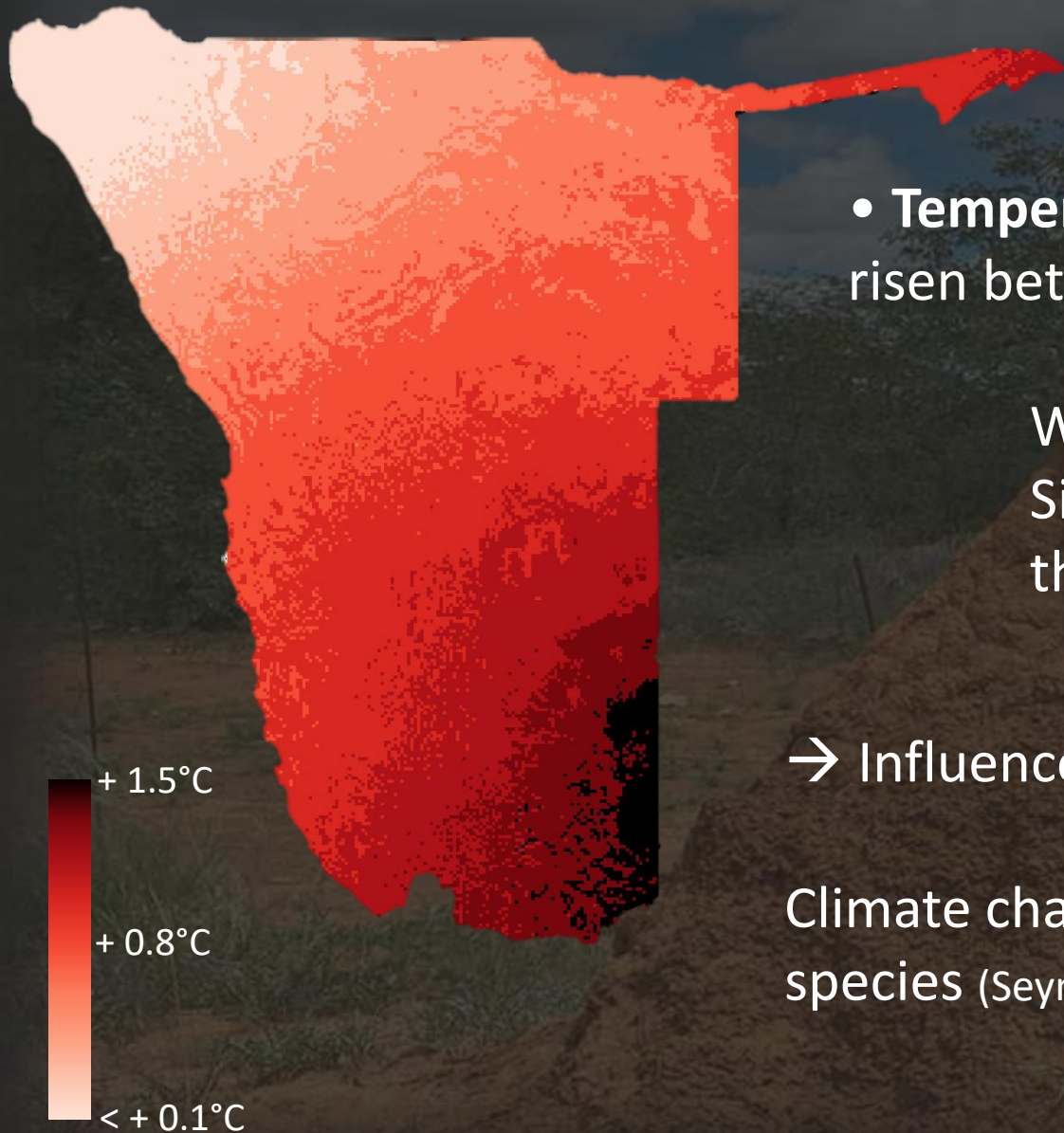
Environmental relations: temperatures

- **Temperature increase:** Generally, temperatures have risen between the two periods

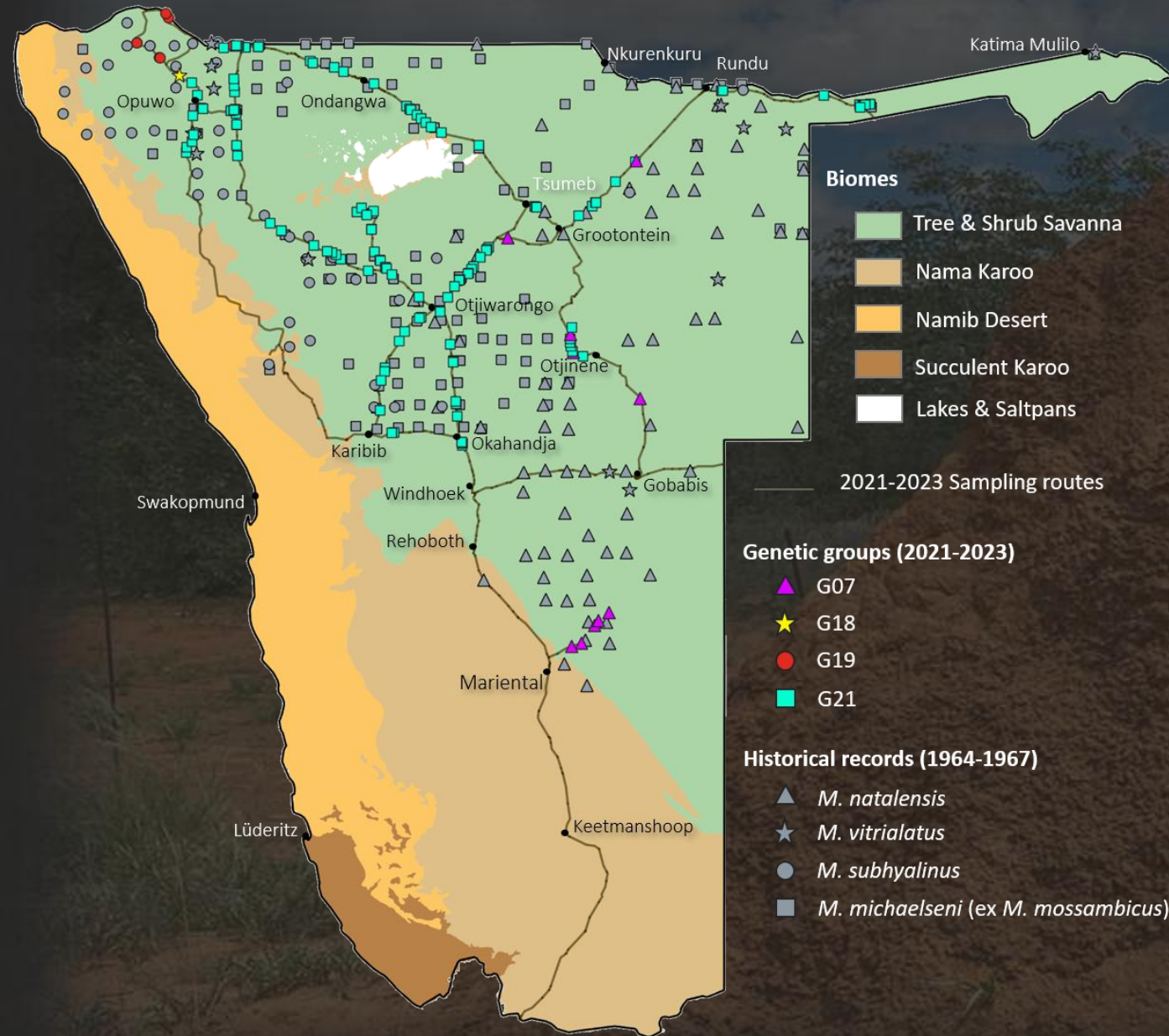
Wilcoxon signed-rank test for paired samples
Significant differences between the two period at the historical sampling points ($V = 15.5$, $p < 0.001$)

→ Influence of temperature rise on distribution?

Climate change may shift species ranges of some *Macrotermes* species (Seymour et al. 2023)



Conclusions



→ Genetic diversity of *Macrotermes* in Southern Africa: 4 main genetic groups

→ Confirmation of misidentifications of species in databases

→ **Cryptic species:** need for in-depth taxonomic studies + wider sampling

→ Need to integrate morphology, ecology & genetics

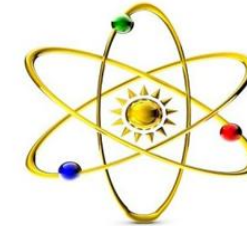
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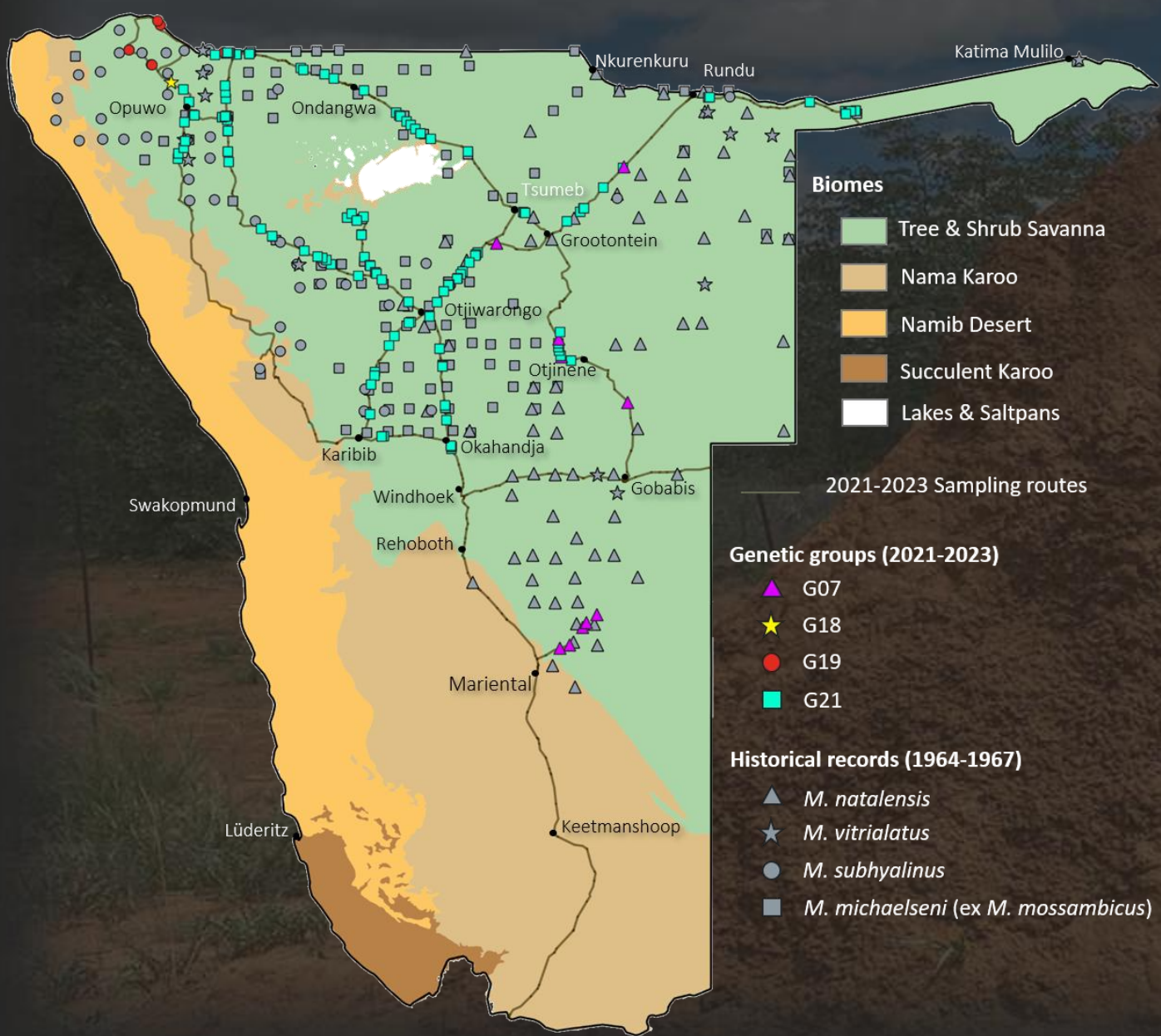
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Thank you!

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