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The diversity of pedogenic trajectories at Sadhana Forest India

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Introduction

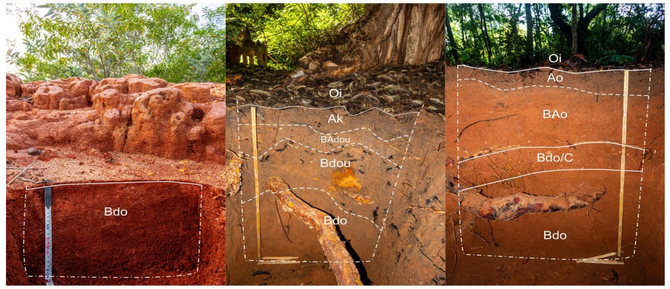
- **Sadhana Forest India** is a reforestation project in Tamil Nadu, India. It has contrasting geology and vegetation; the climate is known to have varied during the Cenozoic.
- Varied conditions create a **wide variety of potential pedogenic trajectories**.
- The pedogenic trajectories at Sadhana forest have **never been studied before**.
- **Goal:** Characterise the diversity of soil types at Sadhana Forest India and their potential pedogenic trajectories.

Materials and methods

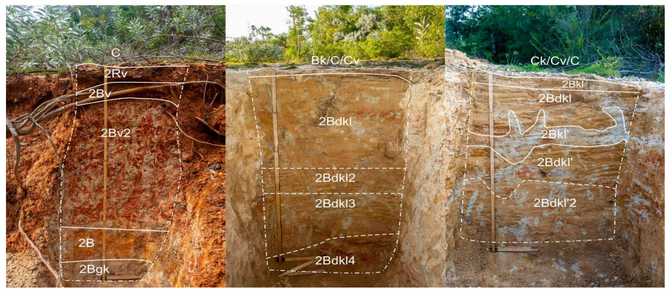
- We dug and described **19 soil profiles** and sampled every soil horizon.
- For these samples, we quantified:
  - Carbon and nitrogen contents.
  - Reductimorphic colours %.
  - Soil pH.
  - Carbonates content.
  - Inorganic carbon stable isotopes.
  - Bulk soil mineralogy (XRD).
  - Total element content (XRF).
  - Extractable Fe and Al speciation.
  - Exchangeable cations.

A) The sixth observed SRGs

Leptosol **Anthrosol** **Ferralsol**



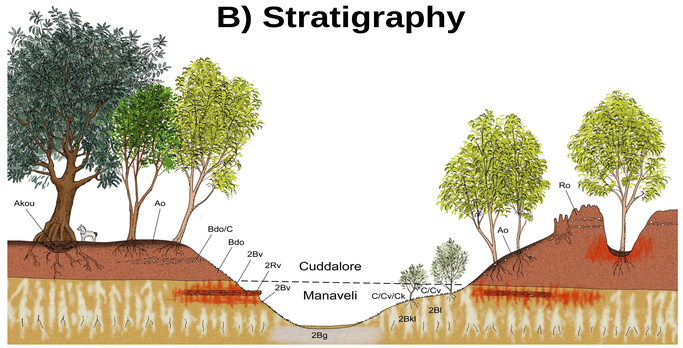
Plinthosol **Regosol** **Calcisol**



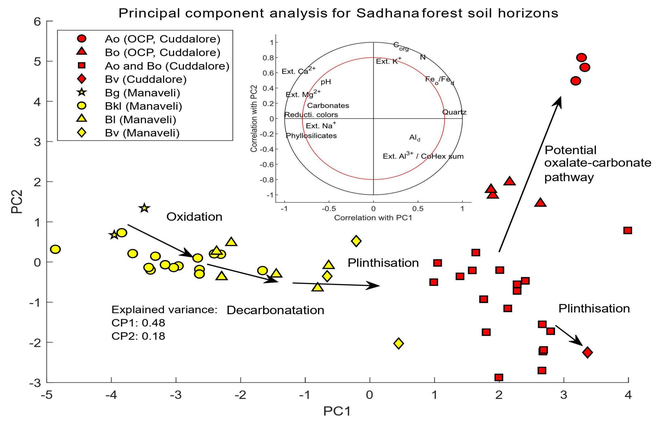
Results and discussion

- We identified **6 soil reference groups**. (SRGs, Fig. A).
- We found Calcisols close to Ferralsols, which is uncommon (pH range: 4.1 to 9.2).
- We identified a **specific stratigraphical order** (Fig. B).
- Inorganic carbon stable isotopes showed that **carbonates** in Calcisols are of **pedogenic origin** ($\delta^{13}C$: -11.5 to -9.53).
- We identified biogeochemical differences and specific **pedogenic trajectories**, including a potential **oxalate-carbonate pathway** (OCP, Fig. C).
- The OCP is discussed in more detail in the work of Rieder C. (2021). Go see her Eurosoil 2021 poster !
- By combining stratigraphy, biogeochemistry and literature, we were able to propose a hypothetical **timeline** for soil genesis (Fig. D).

B) Stratigraphy



C) Biogeochemistry



D) Timeline

Era	Period	Epoch	Age	Event
Mesozoic	Quaternary	Holocene	0.0117 Ma	Deforestation, erosion, reforestation.
		Pleistocene	2.58 Ma	
	Neogene	Pliocene	5.333 Ma	
		Miocene	23.03 Ma	Cuddalore sandstone deposition in an alluvial environment followed by lateritisation of Cuddalore sandstone and decarbonatation, acidification and plinthisation of Manaveli clay.
	Paleogene	Oligocene	33.9 Ma	C4 plants evolution
		Eocene	56.0 Ma	Arid climate, pedogenic carbonates formation under C3 vegetation and upland mottling ?
		Paleocene	66.0 Ma	Manaveli clay deposition in a marine shelf environment.

Conclusion

This was the first attempt to understand the pedogenic diversity present in this region of Tamil Nadu. **Pedogenesis was extremely diverse** and displayed remnants of various superimposed pedogenic processes. This complex history was written on the talismann of the diverse soil types, present at our sites. This work has helped to **decipher pedogenesis** in the local region and could help current reforestation efforts

Aknowledgments

- The Sadhana forest volunteers.
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