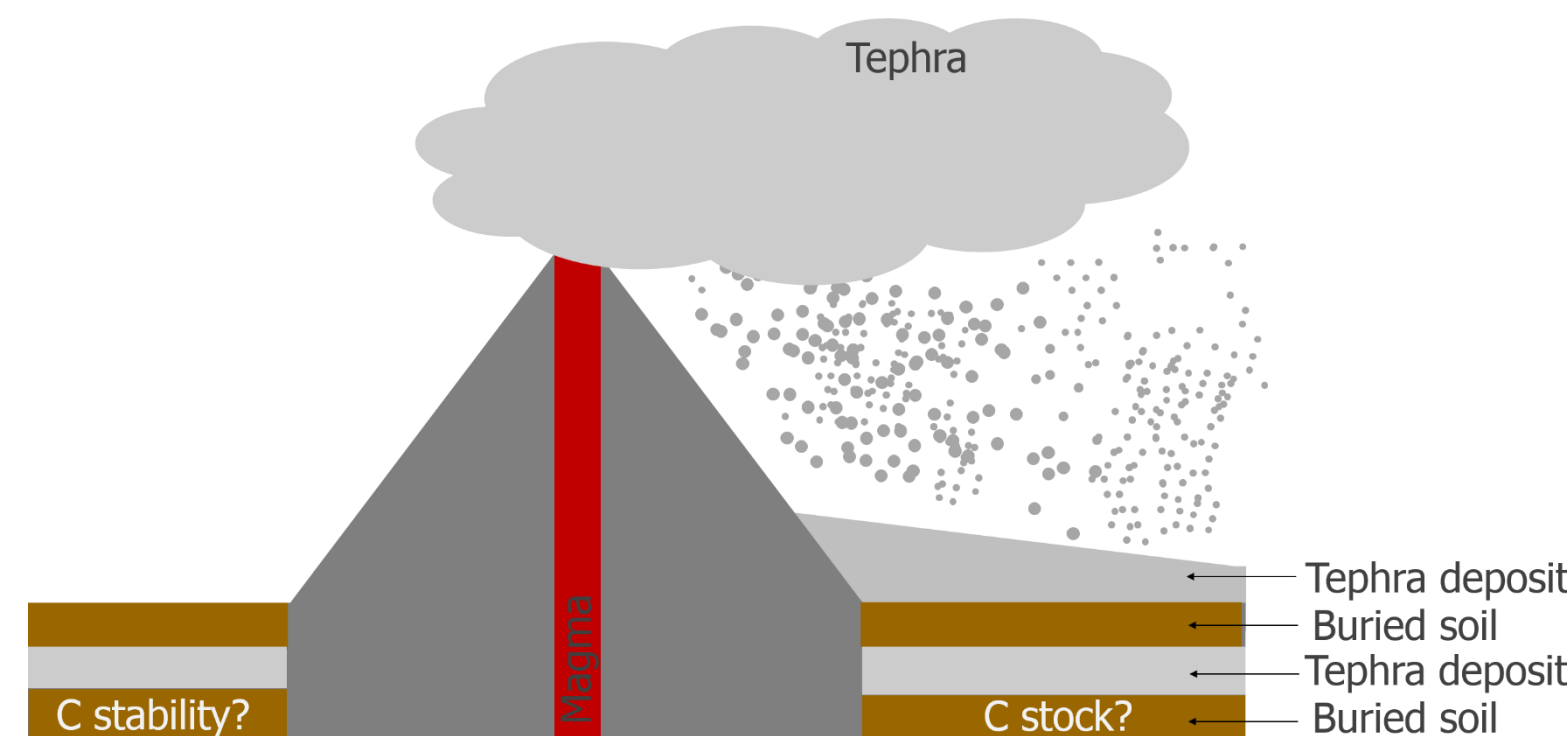


# Stock and stabilisation of organic carbon in tephra-buried volcanic soils: a case study in the northern Ecuadorian Andes.

## Introduction

Major uncertainties in estimates of organic C trapped in soils and the mechanisms that stabilise it may impede accurate climate predictions for the future. Recent studies suggest that buried soil C represents a large and poorly constrained reservoir. In volcanic active regions, soils are repeatedly buried by tephra from explosive eruptions.

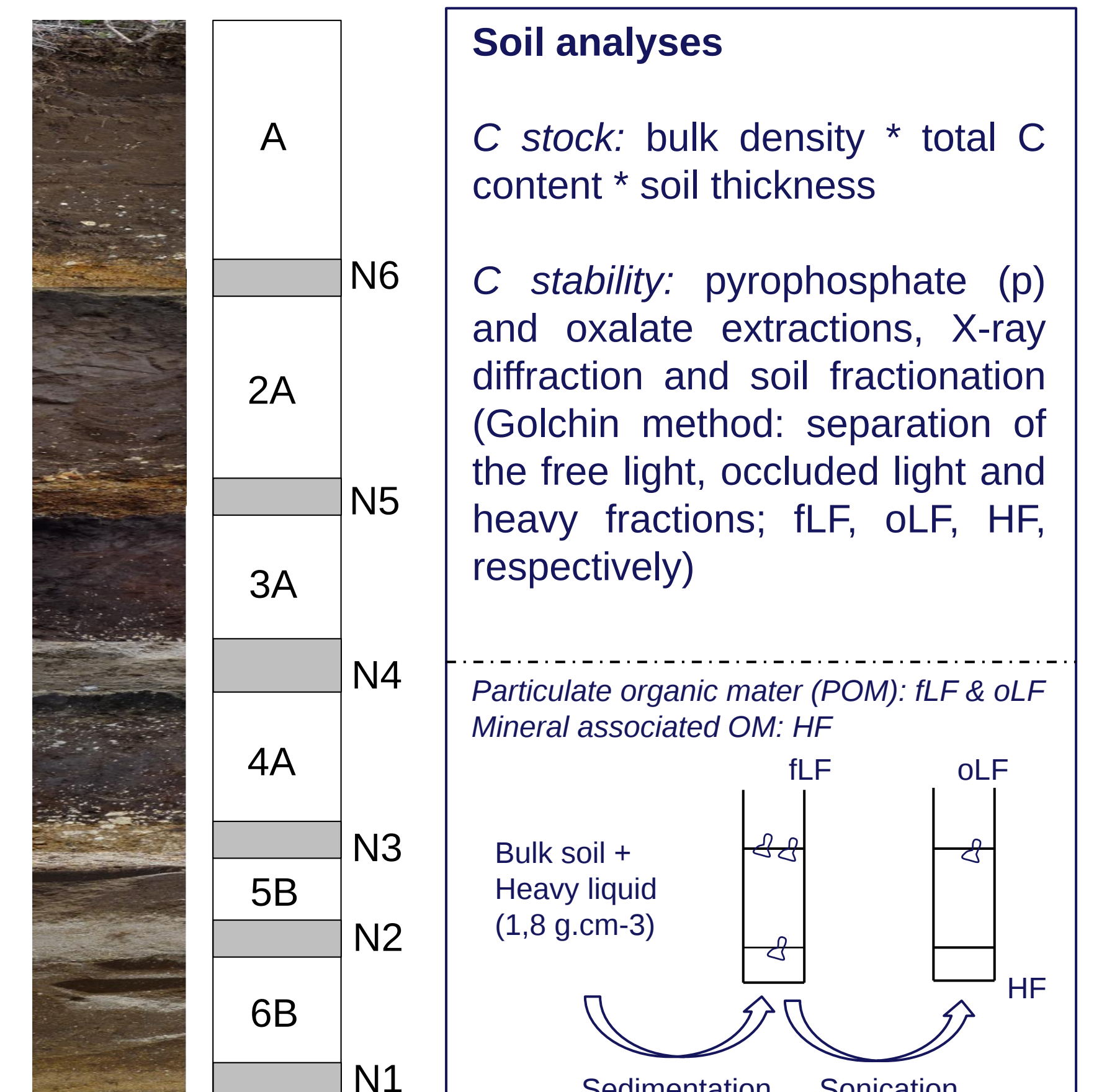
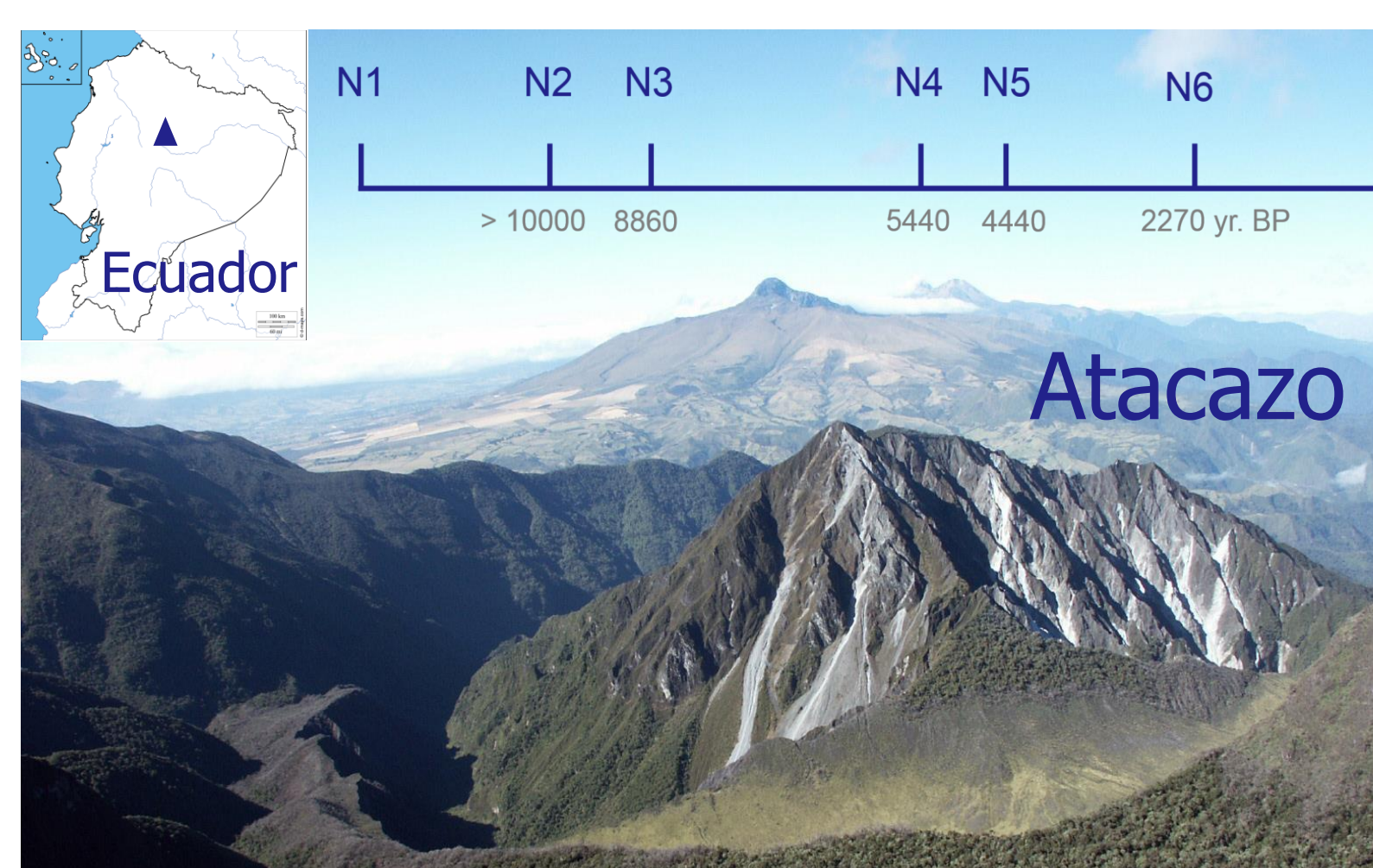


### Objectives:

- (i) to demonstrate that tephra-buried soils represent a significant, but largely underestimated stock of organic C.
- (ii) to identify the main mechanism(s) responsible for C stabilisation in these soils.

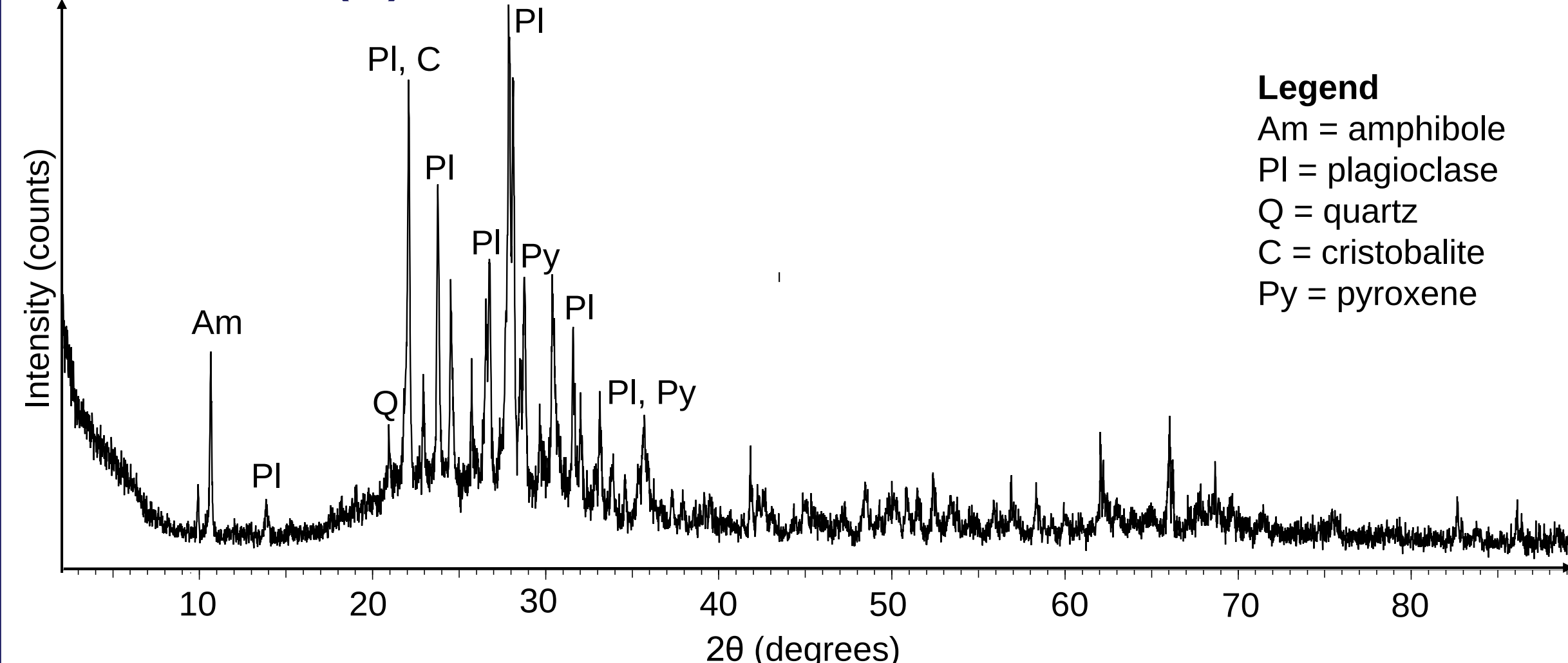
## Material and Methods

Our study site is a 4.8-m deep polygenic volcanic soil profile located at 4080 m a.s.l. in the Ecuadorian Andes.



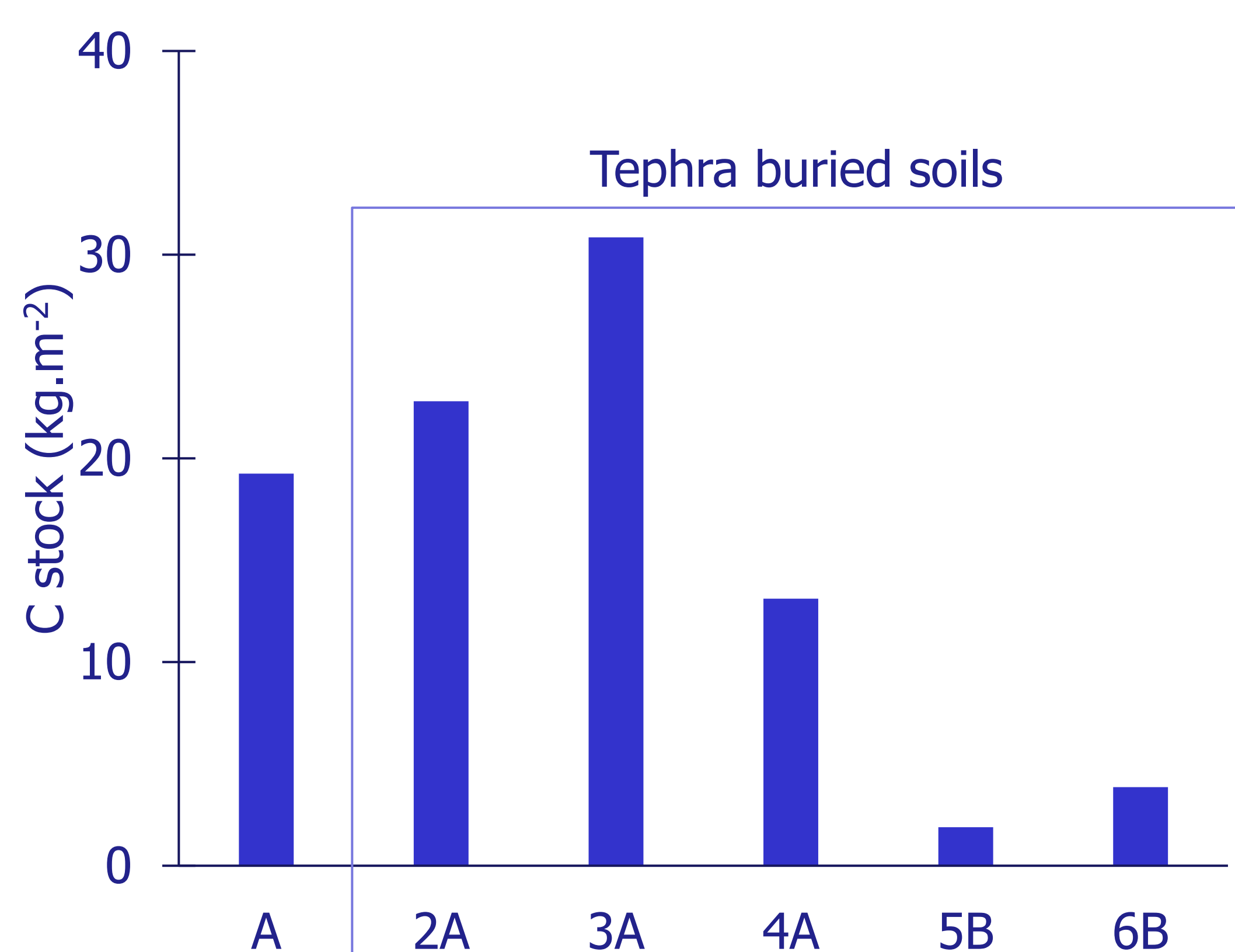
## Results and Discussion

### (1) The soils are Vitric Andisols



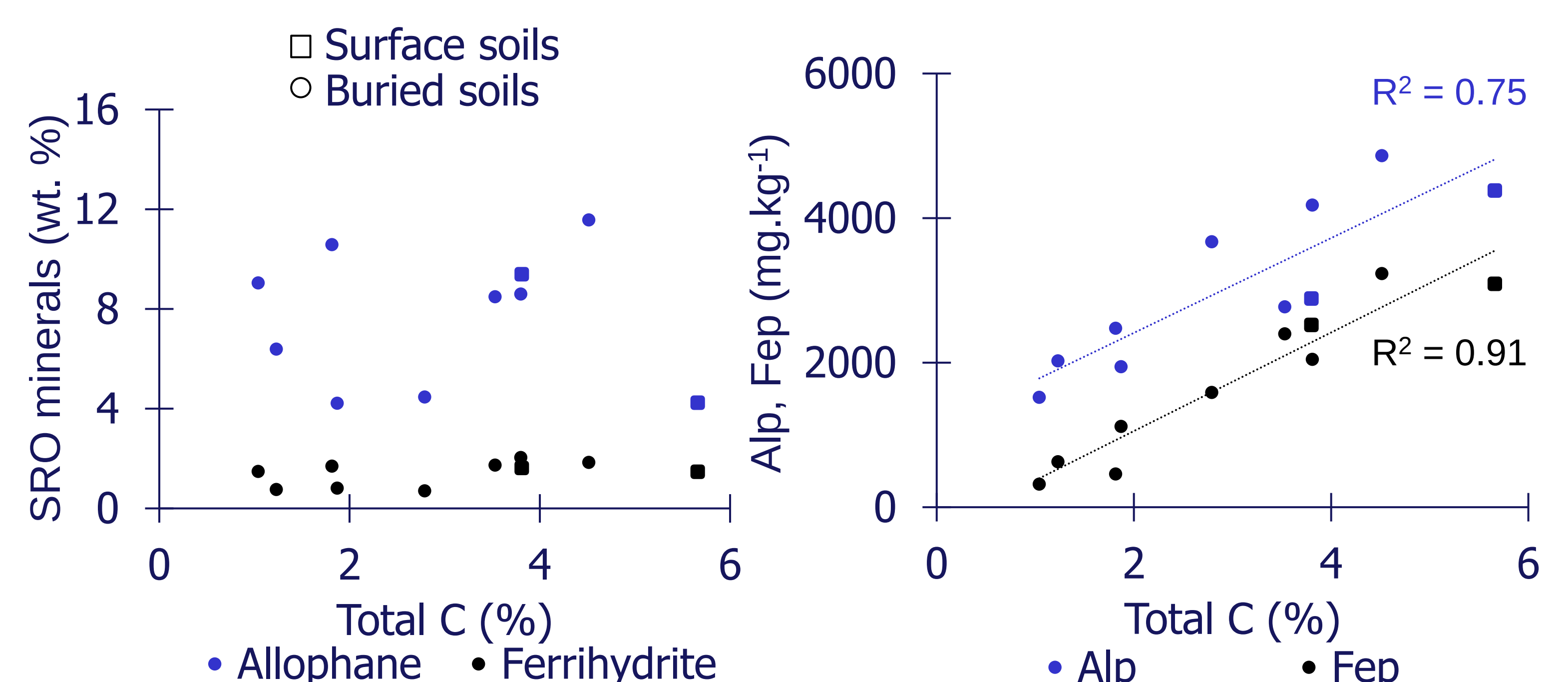
All soil horizons are dominated by primary aluminosilicates. They contain < 13 wt.% of short range order (SRO) minerals.

### (2) The tephra buried soils contain large C stocks



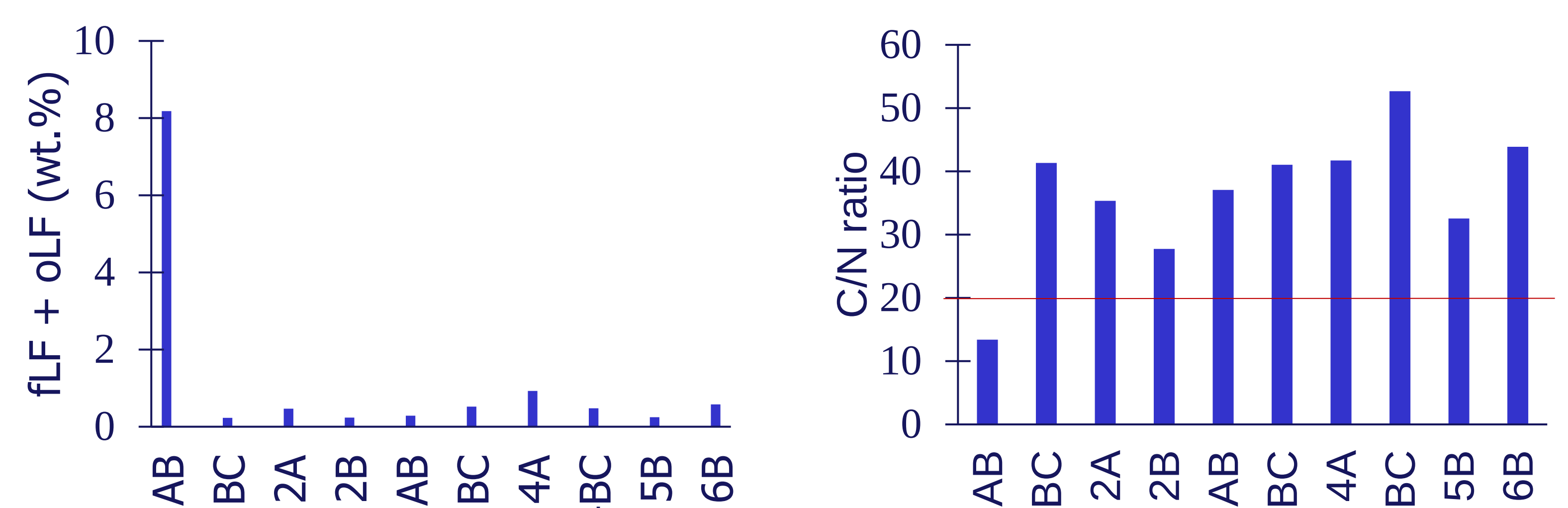
The total C stock in the five tephra-buried soils is ~70 kg.m<sup>-2</sup>; whereas C stock in the surface soil is ~20 kg.m<sup>-2</sup>, i.e. 3.5 lower.

### (3) Organic C stabilisation involves organo-metallic complexation



Total C strongly correlates with Alp and Fep, suggesting organo-metallic complexation as a potential stabilisation mechanism for organic C.

### (4) Lower (fLF + oLF) fraction in the subsurface and buried horizons



The HF is the main fraction in all soils horizons (> 92 wt.%), and most of the OM is found in this fraction (>75%). Moreover, this trend is even stronger for the subsurface and buried horizons, pointing to a loss of fLF+oLF when there is no fresh input of OM. In these horizons, the C/N ratio is higher than 20, implying that microbial degradation of OM may be impeded.

## Conclusion

Our results highlight a large C stock associated with tephra-buried soils. In active volcanic regions, the C stock of Andisols is probably underestimated. Organo-metallic complexation is likely a stabilisation mechanism for organic C in both the surface and buried soils. POM tends to disappear in the subsurface and buried horizons, suggesting its degradation in absence of OM input. Little is known about organic C in buried volcanic soils, and further studies on its stock and fate in active volcanic regions are advocated.