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Soil Record of the Holocene Paleofires at the North of European Russia (Arkhangelsk Region)

Nikita Mergelov, Dmitry Petrov, Andrey Dolgikh, Elya Zazovskaya
Soil Geography and Evolution Department
Institute of Geography, Russian Academy of Sciences, Moscow

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Study area: Pinega, Arkhangelsk Region, Russia

Study area: karst landscapes with *Pinus sylvestris* forest

Regular matrix of closed karst sinkholes

Carbonate and sulfate rocks covered by sandy/sandy loam glacial deposits

Subsidence sinkholes:
400-1000 per km^2
$\varnothing$ = 1-10 m
day surface Δ = 1-5 m

Pyrogenic archives in sinkhole traps

charcoal accumulation zone | charcoal transportation/accumulation zone | charcoal depletion zone

5-20 m distance between zones

Dominant processes controlling the completeness of the charcoal record

cycles of deposition | erosion-deposition / uprooting | erosion / uprooting

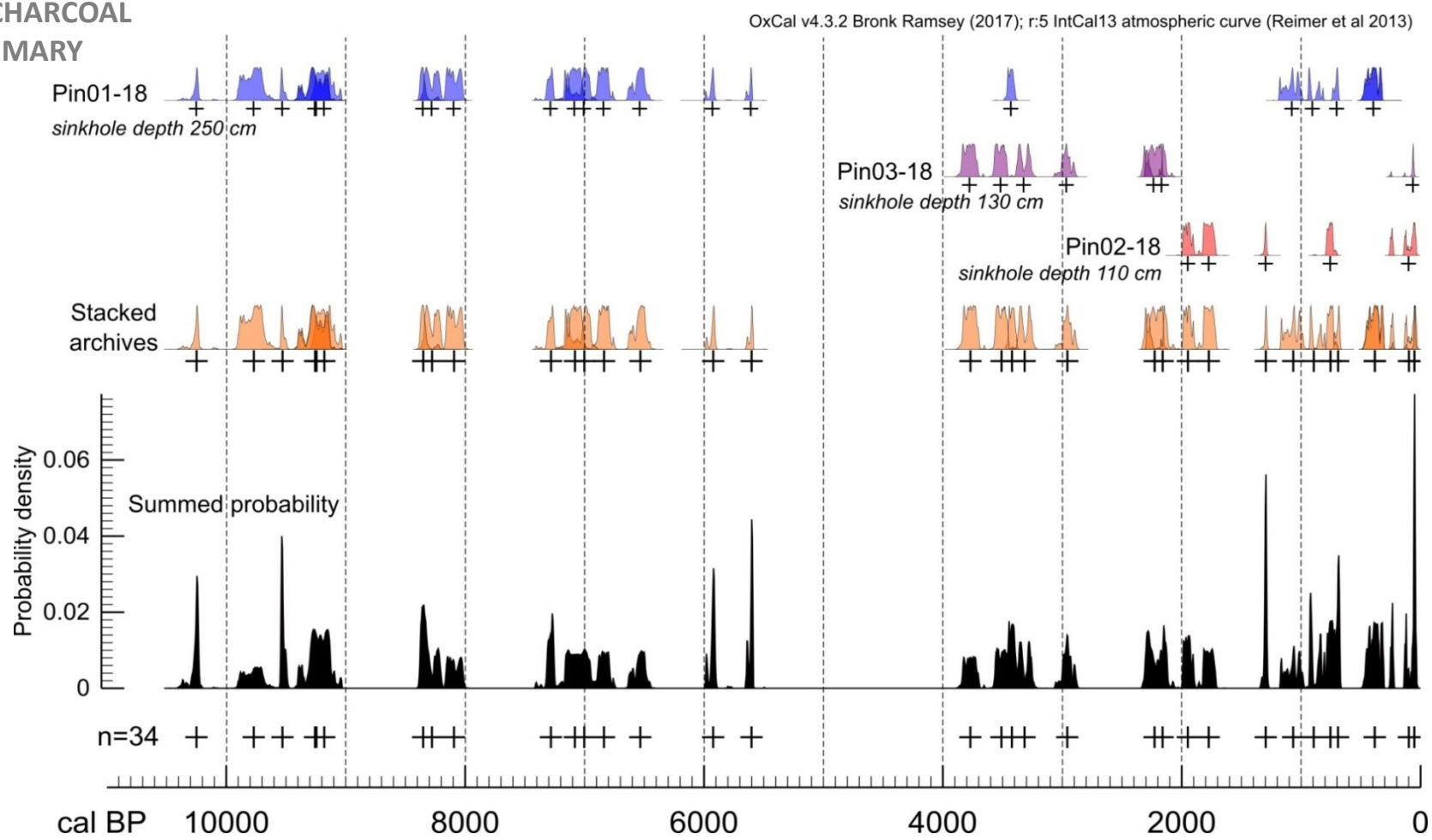
Study objective: to evaluate the series of buried Podzols in karst sinkholes as local-scale archives of the forest paleofires

Results

MACROCHARCOAL SUMMARY

3 complementary pyrogenic archives in sinkholes of various size:

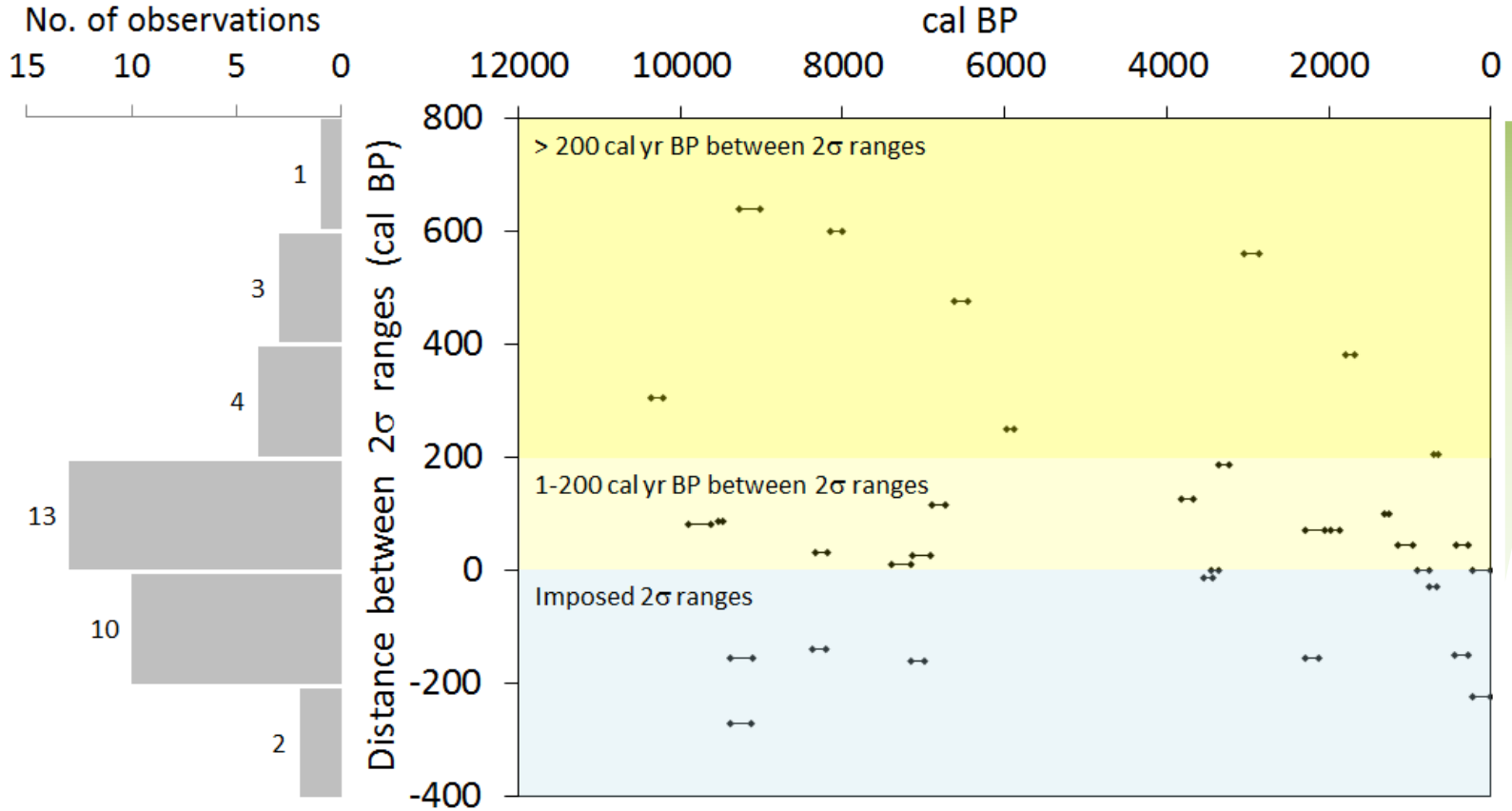
probability distributions and medians (+) in a set of 34 ^{14}C determinations (macrocharcoal)



Results

MACROCHARCOAL SUMMARY

Distances between 2σ ranges (cal BP, 95,4% probability) for each ^{14}C determination in a row of consecutive pyrogenic events (macrocharcoal data)



Reliability of distinguishing individual fires (depends on mitigating uncertainty caused by the "inbuilt age" in ^{14}C age of charcoal)

Conclusion

- Subsidence sinkholes in the karst landscapes (north of Arkhangelsk region, Russia) contain well-preserved soil record of the local pyrogenic events throughout the most part of the Holocene, as well as the data on stages of soil formation during this period
- The maximum temporal “depth” of archives estimated upon the study of 3 sinkholes is 10,261±40 cal BP. Since this time, the paleofire record encompasses every millennium except for 5000–4000 cal BP
- 8 out of 34 ^{14}C determinations in a consecutive row demonstrate distances of more than 200 cal BP between 2σ ranges (95,4% probability) of neighbor-determinations. Thus, these ^{14}C dates reliably distinguish individual paleofires at a threshold of “charcoal inbuilt age” common to the tree species in the Holocene history of the region
- Soil formation at the inter-pyrogenic stages maintained a uniform direction for at least 10,000 yrs and profiles of Podzols were regularly replicated
- *In situ* record of paleofires in numerous pyrogenic-soil archives located in a regular grid of sinkholes complements the *ex situ* sedimentary charcoal record in lakes and bogs