Geochemical peat records from the Great Vasyugan Mire and Tomsk region, Siberia. Regional temporal trend of human impact over the last 500 years and local perturbations.

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Although interest in peatland environments, especially in terms of their carbon storage, has gained momentum in response to a heightened awareness of the climate emergency; significant gaps remain in the geographical coverage of our knowledge of mires, including some major wetland systems. This paucity has implications, not only for our understanding of their development and functioning, but also for adequately predicting future changes and thus providing effective mire environmental management. Our INTERACT-supported study provides radiometrically dated, well-characterised millennial scale peat records from two contrasting undisturbed and impacted (ditched) ombrotrophic sites in the Great Vasyugan Mire (GVM) near Tomsk, Siberia and two additional mesotrophic sites to the east of the Ob river. In addition, the geochemical record was complemented by multiproxy palaeoecological characterisation (pollen, charcoal, stable isotopes, testate amoeba). We identified both natural (lithogenic) and anthropogenic geochemical signals recording human impacts with site specific variations. Elevated trace element concentrations in the peat profiles align with the region's wider agricultural and economic development following the colonisation of Siberia by Russia (from ca. 1600 AD) when pollen assemblages indicate the decline of forest cover and an increase in human disturbance, including the use for fire. Trace element concentrations peak with the subsequent, post WWII industrialisation of regional centres in southern Siberia (after 1950 AD). On a global scale, our sites, together with evidence from the few other comparable studies in the region, suggest that the region's peatlands are relatively uncontaminated by human activities with a mean lead (Pb) level of < 5 mg/kg. However, via lithogenic elements including Rb, Ti and Zr, we detected both a geochemical signal as a result of historical land cover changes enhancing mineral dust deposition following disturbance, as well as fossil fuel derived pollutants as relatively elevated, subsurface As and Pb concentrations of ca. 10 and 25 mg/kg respectively with the development of industry in the region. Nevertheless, the potential significance of local factors on the sites' geochemical profile is also highlighted. For example, we identify the effects of past peat drainage for afforestation (ca. 1960s) and the scheme's subsequent abandonment. Although the region's mire systems are
remote and vast, they appear to hold a legacy of human activity that can be detected as a geochemical signal supporting the inferences of other palaeoenvironmental proxies. Such geochemical peat core records, from Eurasia in particular, remain relatively scarce in the international scientific literature and therefore, as yet, inadequately characterised and quantified compared to other regions.