A geochemical peat record from the Great Vasyugan Mire, Tomsk, Siberia evidencing a regionally coherent pattern of human impact over the last five centuries.

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Interest in peatland environments, especially in terms of their carbon storage, has increased markedly in response to the heightened awareness of future, global climatic conditions. However, significant gaps remain in the spatial coverage of our knowledge of mires; including some major wetland systems. This paucity has implications, not only for our understanding of their origins, development and functioning, but also for adequately predicting future changes and providing scientifically based recommendations for mire environmental management. Our INTERACT-supported study provides a radiometrically dated, well-characterised millennial-scale peat record from two contrasting undisturbed and impacted (ditched) sites, respectively in the Great Vasyugan Mire (GVM) near Tomsk, Siberia, which is reputedly the largest peat system in the world. In addition to their palaeoecological characterisation, we identified both natural (lithogenic) and anthropogenic geochemical signals recording human impacts with site-specific variations. Elevated trace element concentrations in both peat profiles align with the time frame of the region's wider agricultural and economic development with the annexation of Siberia by Russia (from ca. 1600 AD) when pollen assemblage characteristics suggest a decline in forest cover and an increase in herbaceous plants associated with human disturbance. Trace element concentrations peak with the subsequent industrialisation of centres around the Ob river (after ca. 1950 AD). On a global scale, our sites, together with evidence from the few other comparable studies in the region, suggest that the GVM is relatively uncontaminated by human activities with a mean lead (Pb) level of < 4 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, which enhanced 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. Moreover, we identify the local effects of drainage for afforestation (ca. 1960s) on the peat profile. At the impacted site, which was ditched, but subsequently abandoned, the influence of arrested peat growth on the site's geochemical depth profile highlights the
potential significance of local factors. Although relatively remote and vast, the GVM appears 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. Therefore, our study contributes to an understanding of a less well known and, as yet, inadequately characterised and quantified region.