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Paleosol formation during the Early Triassic Biotic Crisis in Norway

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Fractured and kaolinite weathered basement rocks have been discovered in various wells off the Norwegian coast and inferences on timing, source to sink relationships, and environmental implications have been widely discussed. The reason for the kaolitinization has often been related to intensive chemical weathering during late Triassic to early Jurassic times. Chronological control has primarily been inferred from the overlying late Jurassic/early Cretaceous marine transgression and poorly constrained K-Ar datings from weathered basement onshore as well as climate conditions favourable for kaolinite formation.
In this study, we present evidence that the deeply weathered basement off the mid-Norwegian coast represent a complete paleosol profile. Quartz geochemical fingerprinting indicate that transgressional marine inorganic sediments of late Jurassic age are derived from the paleosols. Whole-rock XRD analysis suggests characteristic mineral alteration zones topped with a kaolinite-Fe-oxyhyroxide zones composed of >80% kaolinite. Potassium feldspar is practically absent in the uppermost kaolinitic zones. Mass-balance changes show significant depletion-enrichment trends. Applying potassium/argon (K/Ar) geochronology on authigenic illite clay that grew in-situ at the time of paleosol formation reveals a early Triassic age (∼250 Ma). The age corroborates with the Early Triassic biotic crisis and suggest a causal relationship between intense chemical weathering, high atmospheric CO_2 concentration, extreme ocean warming, increased riverine flux of nutrients and widespread anoxia/euxinia on adjacent epicontinental seas.