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Comment on "Supra-subduction zone ophiolites retain hydrogen generation potential after 300 Myr" by Donzé and Truche (2026)

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Comment

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Paradoxical Conclusions from Contrasting Data Sets. The authors compare the Kempirsay (Urals) and Bulqizë (Albania) massifs, acknowledging substantive differences between the two systems with respect to thermal gradients, ambient temperatures, structural age, and degree of serpentinisation. Notwithstanding these documented differences, the authors conclude that hydrogen generation by serpentinisation proceeds comparably across both systems. This conclusion requires more rigorous justification, as the cited differences in boundary conditions are sufficiently significant to call into question the validity of direct process analogisation between the two settings.

Absence of Quantitative Volumetric Data. The paper does not provide quantitative data on hydrogen degassing volumes. This omission is consequential: as demonstrated by Murray *et al.* (2020), who calculated complete depletion of a hydrogen generating granite system within 147 years against a structural age of 330 million years, the absence of volumetric production data precludes meaningful assessment of whether the proposed serpentinisation mechanism could sustain the observed hydrogen flux over geologically relevant time scales. The referenced laboratory experiments — including those of Devirtz *et al.* (1992) — were conducted on finely crushed rock samples, a condition rarely representative of natural subsurface environments at a practically significant scale. The experiments of Devirtz *et al.* (1992) involved thermal treatment of already serpentinised dunite samples rather than initiation of serpentinisation reactions from unaltered protolith material. Consequently, hydrogen generation documented in these experiments cannot be attributed to active serpentinisation processes — a point not contested by the authors — rendering its invocation as evidence for serpentinisation driven hydrogen generation a mischaracterisation of the original study's findings. It is also noteworthy that Ukhanov *et al.* (1987), cited in this paper, proposed a deep seated origin for hydrogen at Kempirsay — a hypothesis not addressed in the present paper.

Contradictory Redox Characterisation and the Coexistence of Oxidising and Reducing Environments. The authors assert that the associated reduced gases are attributable to serpentinisation driven hydrogen production. This attribution is internally inconsistent with the oxidising conditions required by the hydrogen generating serpentinisation mechanism. The simultaneous presence of awaruite, native iron, and Fe-Ni alloys — unambiguous indicators of a strongly reducing environment — alongside a proposed hydrogen generation mechanism requiring Fe^{2+} oxidation represents a genuine and unresolved geochemical contradiction. This inconsistency could and should have been evaluated using the FMQ buffer as the standard redox reference frame, the application of which would have provided a quantitative thermodynamic constraint on whether the proposed oxidising and reducing conditions could coexist within the same reaction cell — which, as the literature confirms, they cannot under equilibrium conditions. The authors' attempt to reconcile this contradiction by proposing that serpentinisation is spatially localised along a subset of high permeability structures, whilst reducing assemblages persist elsewhere in the same system, is speculative and lacks mechanistic substantiation. The presence of strongly reducing mineral assemblages is more appropriately interpreted within the reductive fluid framework described by Yurkova *et al.*, (1982), whose experimental observations directly contradict the oxidising media assumption central to the serpentinisation model advanced in the present paper).

Unsupported Inference Regarding Hydrogen and Methane Co-genesis. The authors infer from young radiocarbon ages of methane that associated hydrogen must also be recently produced, implying active contemporaneous hydrogen generation. Whilst the young age of methane is consistent with abiogenic formation pathways described by Yurkova (1991), this does not constitute evidence that hydrogen was generated simultaneously with methane through serpentinisation. The assertion conflates temporal correlation with mechanistic co-genesis in a manner not supported by the data presented.

Alternative Structural Controls not Considered. The authors do not adequately consider the structural geology of the Kempirsay massif as an alternative explanation for the spatial confinement of hydrogen seeps. The massif is located along a regional fault zone of rift-related genesis, characterised by steeply dipping supply channels and pronounced rock schistosity Saveliev *et al.* (2002) — structural features consistent with deep seated fluid degassing along pre-existing tectonic pathways. The authors' exclusive focus on chromitite proximity as

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the controlling factor omits consideration of these well documented structural controls.

Spatial Coincidence does not Establish Genetic Causality. The assertion that chromitites and their surrounding damage zones play a central role in both hydrogen production and migration is presented as an established conclusion on the basis of spatial proximity alone. In geoscience, the spatial coincidence of two phenomena does not constitute proof of their genetic relationship. This fundamental principle of scientific inference requires that causal relationships be independently demonstrated rather than assumed from spatial correlation (Pennsylvania State University, 2021).

Literature Coverage on Chromitite Catalysis is Incomplete. The characterisation of chromitites as catalytic enhancers of hydrogen related processes as underexplored does not accurately reflect the available literature. The role of chromite and associated platinum group minerals — particularly ruthenium — in catalysing hydrogen and methane generation in ophiolitic settings has been addressed in detail by Pappalardo *et al.* (2025) and Etiope *et al.* (2018), among others. Notably, Chashchukhin *et al.* (2020) documented methane formation in completely unserpentinised fresh ultramafic rocks at Kempirsay, in which no hydrogen was detected — an observation directly relevant to the proposed reaction mechanisms that is not discussed in the present paper.

Chicken-and-Egg Problem with Meteoric Water and Serpentinisation. The proposed two scale hydraulic architecture, in which regional faults supply meteoric water to chromitite-centred reaction sites, raises an unresolved temporal paradox: it is unclear whether meteoric water ingress initiated the serpentinisation process, or whether serpentinisation generated the mechanical permeability through which meteoric water subsequently accessed the reaction zone. This ambiguity is fundamental to the proposed model and requires explicit resolution.

Preservation Mechanism for Reactive Mantle Domains is Unexplained. The proposition that ophiolitic mantle domains preserve reactive ultramafic material capable of sustaining hydrogen generation over hundreds of millions of years is presented without a credible physical mechanism to account for such long-term preservation against the background of ongoing geodynamic, metamorphic, and tectonic processes. The argument would be substantially strengthened by the identification and discussion of a plausible preservation mechanism.

Summary. The paper presents a well-structured framework for interpreting chromitite hosted hydrogen systems; however, several interpretive conclusions are weakened by internal geochemical inconsistencies, incomplete treatment of the existing literature, and the absence of quantitative volumetric data necessary to substantiate the proposed mechanism on geochronological timescales. The absence of formal reaction equations for the proposed geochemical processes materially impedes rigorous independent evaluation of the authors' reasoning. A more rigorous engagement with alternative hypotheses — including deep seated hydrogen degassing from crustal and mantle sources — and a consistent treatment of the coexisting redox environments would substantially strengthen the scientific case advanced by the authors.

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Additional Information

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References

Chashchukhin, I.S., Votyakov, S.L., Pankrushina, E.A. (2020) First methane finding in the olivine from ultramafites unaffected by serpentinisation. *Proceedings of the Fersman Scientific Session, Geological Institute, Kola Science Centre of the Russian Academy of Sciences* 17, 543–546. https://doi.org/10.31241/FNS.2020.17.105

Devirtz, A.L., Gagauz, F.G., Grinenko, V.A., Lagutina, E.P., Pereverzov, V.V., Shukolyukov, Y.A. (1992) On the origin of hydrogen in ultrabasic rocks of the Kempirsay massif. *Geokhimiya* 8, 1084–1093.

Donzé, F.V., Truche, L. (2026) Supra-subduction zone ophiolites retain hydrogen generation potential after 300 Myr. *Geochemical Perspectives Letters* 40, 1–6. https://doi.org/10.7185/geochemlet.2614

Etiope, G., Ifandi, E., Nazzari, M., Procesi, M., Tsikouras, B., Ventura, G., Steele, A., Tardini, R., Szatmari, P. (2018) Widespread abiotic methane in chromitites. *Scientific Reports* 8, 8728. https://doi.org/10.1038/s41598-018-27082-0

Murray, J., Clément, A., Fritz, B., Schmittbuhl, J., Bordmann, V., Fleury, J.M. (2020) Abiotic hydrogen generation from biotite-rich granite: A case study of the Soultz-sous-Forêts geothermal site, France. *Applied Geochemistry* 119, 104631. https://doi.org/10.1016/j.apgeochem.2020.104631

Pappalardo, L., Buono, G., Procesi, M., Etiope, G. (2025) The link between ophiolitic chromitites, natural hydrogen and methane: Insights from 3D microtomography. *Chemical Geology* 676, 122575. https://doi.org/10.1016/j.chemgeo.2024.122575

Pennsylvania State University (2021) *1.4: Correlation vs. Causation.* https://geo.libretexts.org/Bookshelves/Geology/Engaging_Adults_in_Science_and_Energy/01%3A_Process_of_Science/1.04%3A_New_Page

Saveliev, D.E., Makatov, D.K., Portnov, V.S., Gataullin, R.A. (2022) Morphological, textural and structural features of chromitite deposits of Main ore field of Kempirsay massif (South Urals, Kazakhstan). *Georesursy* 24, 62–73.

Ukhanov, A.V., Devirtz, A.L., Ivanov, N.D. (1987) Isotopically light hydrogen at Kempirsay (South Urals). *Doklady Akademii Nauk SSSR* 293, 700–704.

Yurkova, R.M. (1991) *Mineral transformations of the ophiolite and associated volcanic-sedimentary complexes in the Northwestern Pacific Fringing.* Transactions 464, Academy of Sciences of the USSR, Moscow.

Yurkova, R.M., Slonimskaya, M.V., Daynyak, B.A., Drits, V.A. (1982) Hydrogen and methane in genetically different serpentine types from Sakhalin and the Koryak mountains. *Doklady Akademii Nauk SSSR* 263, 420–425.