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Water subduction processes constrained by halogens and noble gases in the Sanbagawa metamorphic rocks

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The subduction of sedimentary-pore-fluid-like halogens and noble gases is supported by several studies. These include noble gases and halogens with seawater and sedimentary pore-fluid signatures in exhumed mantle wedge peridotites from the Sanbagawa-metamorphic belt, southwest Japan [1] and from the Horoman peridotite massif, north Japan [2], mantle-derived xenoliths from Kamchatka and Luzon arcs [2], and in seafloor and forearc serpentinites [3] along with seawater-like heavy noble gases in the convecting mantle [4]. New halogen and noble gas data for serpentinite and metapelite samples from the Sanbagawa belt with a wide range in peak metamorphic *P–T* conditions (0.7–2.0 GPa and 430–600°C) [5] show striking similarities with data from samples of peridotite [1], eclogite, and quartz vein in metapelites and eclogites [6] from the same metamorphic belt and also with those of mantle-derived rocks from other subduction zones [2]. The ubiquitous occurrence of sedimentary-pore-fluid-like subduction fluids associated with a small contribution of components of sediment or altered oceanic crust is best explained by a model where water with a pore-fluid signature is incorporated into subducting oceanic lithosphere as serpentine along fracture zones developed at the outer rise without significant modification in the halogen and noble gas compositions, and the halogen and noble gas signatures in fluids released by the serpentine dehydration are preserved due to highly channelized flow in the mantle wedge [2].

[1] Sumino *et al.*, *EPSL* 2010. [2] Kobayashi *et al.*, *EPSL* 2017. [3] Kendrick *et al.*, *Nature Geosci.* 2011. [4] Holland & Ballentine, *Nature* 2006. [5] Kouketsu *et al.*, *Island Arc* 2014. [6] Sumino *et al.*, *Mineral. Mag.* 2011.