

Hydrogen seepage from shallow circular depressions

VIACHESLAV ZGONNIK¹, NIKOLAY LARIN¹, VLADIMIR N. LARIN¹,

¹ Natural Hydrogen Energy Ltd. 819 35th avenue, Greeley 80634 Colorado, USA zgonnik@NH2E.com

We identified thousands of sites on the European part of Russia [1] and the Atlantic Coastal Plain Province of the USA [2], where natural hydrogen gas is seeping out of shallow surface depressions. These range in size from a hundred meters to several kilometers in diameter and there are hundreds of thousands of these structures worldwide. We tested some of them for the presence of hydrogen and, using the data we obtained, we estimated the flow of hydrogen gas.

For some locations in Russia and USA, the amounts range up to 27 000 m³ H₂ per day. In one well, drilled near to one of those places, the detected concentration of hydrogen is 32%.

We studied potential mechanisms for H₂ production and concluded that hydrogen apparently originates from a geochemical processes taking place under the sedimentary pile and then migrates towards the surface. One plausible hypothesis for the origin of H₂ explains it as being fluxes of primordial hydrogen [3].

We interpreted observed depressions as being the result of local collapses caused by the alteration of rock along deep pathways of H₂ migrating towards the surface. Hydrogen flow is also associated with other volatile elements like helium and mercury, what confirms that depressions are surface expressions of migrating channels for fluids. Considering the age of these depressions, it is possible that some hydrogen flows may last for thousands of years.

Hydrogen is the most energy-rich gas and is currently considered to be a good candidate to replace fossil fuels. Exploration of these substantial sources of natural hydrogen gas may give a boost to the hydrogen economy.

1. Larin N V., Zgonnik V, Rodina S, Deville E, Prinzhofer A, Larin VN. Natural Molecular Hydrogen Seepage Associated with Surficial, Rounded Depressions on the European Craton in Russia. *Natural Resources Research*. 2015, 24(3), 369-383. doi:10.1007/s11053-014-9257-5.

2. Zgonnik V, Beaumont V, Deville E, Larin N V., Pillot D, Farrell KM. Evidence for natural molecular hydrogen seepage associated with Carolina bays (surficial, ovoid depressions on the Atlantic Coastal Plain, Province of the USA). *Progress in Earth and Planetary Science*. 2015, 31(2). doi:10.1186/s40645-015-0062-5.

3. See in this book of abstracts: "New predictive model for composition of inner planets".