

# **Natural hydrogen emission and distribution at the hydrothermal vent fields in the Central Indian Ridge**

WONNYON KIM, JIHYE OH, HEEJUN KIM, GYUHA HWANG AND JONGUK KIM

Korea Institute of Ocean Science & Technology

Hydrothermal vents are one of the primary pathways through which materials from Earth's interior are discharged to the surface. Notably, a significant amount of natural hydrogen ( $H_2$ ) is emitted from the vents. The water-rock interaction, particularly with iron-rich mafic and ultramafic rocks, is recognized as a major geological process responsible for  $H_2$  formation. In this study, we investigated active vent areas along the Central Indian Ridge to better understand  $H_2$  emissions, including concentration near vent orifices and dispersion patterns around the vents. A hydrogen sensor was attached to an ROV to determine the spatial distribution of  $H_2$ , while vent plume sampling was conducted using an ROV-mounted Niskin bottle to measure the gas concentrations. The  $H_2$  sensor measurements exhibited a strong correlation with ORP signals, which are commonly used as indicators of vent plumes, confirming that the vent system serves as the primary  $H_2$  source in the study area. In general, vent regions with ultramafic rock basements exhibited high  $H_2$  concentrations, with the highest at the Onnuri Vent Field. The dispersion patterns of  $H_2$  varied among vent sites, which was attributed to differences in the direction and strength of bottom currents in each region. Meanwhile, gas composition analysis of the plume revealed that the highest  $H_2$  was detected at the Saero Vent Field, where the bedrock is primarily composed of basalt. These findings suggest that  $H_2$  generation reactions occur in the deeper subsurface, which is predominantly composed of ultramafic rocks. Recent geomagnetic studies have also demonstrated that newly erupted basalt has altered pre-existing seafloor geomagnetic patterns. Although certain limitations exist,  $H_2$  sensor has proven to be a highly effective tool for understanding  $H_2$  distribution characteristics and identifying major emission sites on the seafloor.