CO_2 leakage in the deep ocean and its effect on benthic fauna

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One of the future strategies to deal with excess CO_2 in the atmosphere is its disposal and storage in the ocean. The environmental risks of this mitigation strategy are not well constrained. Critical questions to any disposal scenario are as to the tipping points at which endemic species are affected by increasing pCO_2 and decreasing pH, and as to the threshold for CO_2 leakage from the seafloor to prevent negative effects on biodiversity and ecosystem services. During a recent expedition to the Okinawa Trough we have used the ROV QUEST and a towed TV camera equipped sensor system to investigate the potential effects of natural CO_2 leakage from hydrothermal vents on deep-water benthic ecosystems at 1350 m water depth. At the Yonaguni Knoll vent system, volcanic CO_2 emissions lower the pH of the bottom water to 7.2, with dramatic effects on megafauna distribution and composition. Echinoderms, sea anemones and some tube building polychaetes were restricted to bottom waters with a pH > 7.4. Only few types of hydrothermal vent fauna such as *Bathymodiolus platifrons, Alvinocaris longirostris, Shinkaia crosnieri* were found adapted to life at very low pH, and showed massive biomasses directly at the CO_2 vents. Curiously, all three key species have carbonate containing shells and carapaces, indicating unknown biological mechanisms supporting calcification and protecting carbonates at high CO_2 and low pH.

Application of natural and modified materials for waste treatment

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The huge amount of waste has been collected in the world during last century as a result of industrial activity. The given work is focused on solving of the problem connected with immobilization and long-term retention of the nuclear and ore mining industries' waste because of the high concentration of technogenic radioactive nuclides and heavy metals. In the given work effective ways of liquid and solid waste treatment have been developed on the basis of natural (clay, peat, limestone, etc.) and modified materials (peat-humic agent (PHA), organic-mineral complex, etc.). The combination of field, experimental, mineralogical, physical and chemical research has been applied for solving this problem. Various methods, such as chemical methods, AAS, IRS, XRD and SEM, were used for this research. The chemical compounds of technogenic water and solid waste were investigated in details. The methods for modification of natural materials were offered to intensify sorption properties of clay minerals and peats. For example, peat-humic agent has been produced on the basis of peat from "Krugloe" deposit (Novosibirsk region, Russia) by mechanical, chemical and thermobaric effects. This agent has more humic acids and functional groups, especially carboxyl, than peat. Peat-humic agent was used to modify kaolinite clay in order to create organo-mineral complex. Clay modified by microaddition of PHA has sorptive capacity in 1.7-2 times higher than natural clay and can sorb metals in extended rating of pH from 5 to 8. Various ways to minimize technogenic influence of wastes were offered as a result of laboratory and field experiments. Organic-mineral geochemical barriers for binding and long-term retention of heavy metals and radioactive nuclides were developed. Methods of acid mine drainage neutralization and decreasing element concentration were offered using the natural and modified materials. Additionally, methods of solid waste conservation and prevention of eolian transportation of tailings particles were offered. The proposed cost-effective method of area decontamination will help to improve ecological situation around industrial facilities.