Submarine groundwater discharge (SGD) associated fluxes of nutrients and trace elements and their budgets were investigated in two coastal embayments, Hwasun Bay and Bangdu Bay, off the volcanic island of Jeju, Korea. The N:P ratios in the coastal groundwater (85±96) were considerably larger than those in the seawater (3.8±1.6) of both bays. The fluxes of dissolved inorganic nitrogen (DIN) through SGD were more than 90% of the net DIN input into both bays; approximately 93% and 39% of SGD-driven DIN was consumed inside Hwasun and Bangdu Bays, respectively. The discharge of DIN through SGD from the entire island was approximately $2.1 \times 10^9$ mol yr$^{-1}$, which is equivalent to some large rivers, potentially supporting approximately $1.6 \times 10^{11}$ g C yr$^{-1}$ of new primary production. In Bangdu Bay, the concentrations of trace elements (Al, Mn, Fe, Co, Ni, and Cu) in summer groundwater were 3 to 40-fold higher than those in winter groundwater, in association with the effective dissolution of Mn- and Fe-oxides in summer groundwater. Our simple budget calculations show that larger fluxes of SGD-driven trace elements are responsible for the unusually enhanced concentrations of Al, Fe, and Co in summer seawater in this bay. Thus, our results highlight that SGD-driven fluxes of nutrients and trace elements from highly permeable islands standing in oligotrophic oceans are very important for their global nutrient budgets and the coastal biological production of the islands.