Long-term performance of a constructed wetland/filter basin system treating wastewater

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The reclamation of wastewater and phosphate mining lands using constructed wetland/filter basin (CW/FB) treatment technology is very important for Florida providing an excellent opportunity for environmental improvement and restoration. In addition, the CW/FB system may provide water that meets drinking water standards to supplement lakes and rivers and to satisfy industrial, agricultural and domestic water supply demands.

The objective of this study was to investigate the possibility to use wetland to improve the chemical composition of waste and surface waters in an area used during phosphate mining for clay settling and sand tailings in Polk County, Florida. The CW/FB system was used for the treatment of a mix of (1) industrial wastewater from a power plant, (2) city effluent, (3) rain, and (4) excess surface water. The length of the wetland was approximately 1500 m long and wetland vegetation was allowed to evolve naturally. Following the wetland the water was filtered through sand to eliminate pathogens, color and odor.

Monitoring was carried out for 18 months to evaluate the CW/FB performance through the dry and rainy seasons. Water samples were taken bi-monthly. To evaluate possible groundwater input into the wetland 6 monitor wells along the wetland were sampled monthly. To estimate the change of water chemistry along the wetland flow path, water samples along a transect were taken during dry and rainy seasons. The samples were analyzed for pH, T, ORP, conductivity, TDS, DO, Fe^{2+}, S^{2-}, major anions, major cations, arsenic (As), and $\delta^{18}O$ and δD, as well as, for fecal and total coliform microrganisms. Our preliminary results showed the following changes in quality from the cooling pond water to the water from the CW/FB system: (1) Change in pH from 9-9.5 to 7-6.5; (2) Decrease of water T of up to 10°C; (3) Decrease of DO from 15 to < 2 mg/L; (4) Reduction of As from 5 to <0.5 µg/L; (5) Increase of S^{2-} from <1 to >2000 µg/L; (6) Reduction of fecal (370 to < 2 #/100mL) and total coliform (2000 to < 100 #/100mL). Despite large seasonal variarions with respect to temperature, rainfall and humidity, the chemical/microbiological composition of treated water remained relatively constant.

Ultramafic-mafic complex of the Pekulney Range (Chukotka, NE Russia): The evaluation of the initial melt composition

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The ultramafic-mafic complex of the Pekulney Range probably representing the large exposure of a lower arc crust comprises several fault-bounded blocks that are composed of dunite, wehrlite and olivine clinopyroxenite (the lower unit), spinel clinopyroxenite (the middle unit), and garnet and garnet-free metagabbro with minor spinel clinopyroxenite (the upper unit) [1]. Mineralogical data indicate crystallization of ultramafics starting from a primitive melt (olivine with Mg# 92.3, spinel with Cr# 0.76) originated through the melting of a refractory mantle peridotite. The further crystallization of this mantle-derived melt was resulted in simultaneous and gradual decrease in Mg# of olivine (up to 73), decrease in Cr# of spinel (up to 0.000) and increase of Al_2O_3 content in clinopyroxene (up to 12 wt. %). The latest crystallization stages are obscured due to nearly total metamorphic replacement of primary minerals in the gabbroic unit. Both high values of Cr#Spl, low TiO_2 contents in primary spinels (below 0.4 wt.%) and high calculated oxygen fugacity (QFM+1.3 and higher) are consistent with generation of the Pekulney complex rocks above a subduction zone. All the rocks of the Pekulney complex show similar multi-element spectra especially in its highly incompatible element part. It suggests that all rocks of the complex from dunites to gabbros are mutually related to each other. The estimated amount of the trapped melt in the cumulative ultramafics, whose composition possibly was close to initial one, was ~2.5 % in average. As to the trace element distribution and abundances this melt resembles boninites. It is characterized by high LREE contents (in particular 9 relative to PM for La) coupled with low level of MREE and HREE contents (below 1 relative to PM). It also exhibits high LILE (Rb, Ba, Th), positive anomalies of Sr, Zr and Hf, and U relative to Th. Therefore the geochemical data are well consistent with primary mineralogy and indicate formation of the Pekulney complex due to evolution of boninite or boninite-like initial melt above a subduction zone.

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[1] Ishiwatari *et al*. (2007) *Island Arc* **16,** 1-3.