Mineralogical characteristics of Reclaimed Flat Tidal Soils Along Western Coastal Line in Korea

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BACKGROUNDS

- **A TIDAL FLAT**, distributed widely along coastlines world-wide, is defined as a flat area or stretch of land consisting of sandy or muddy sediments exposed at ebb tides or as sandy to muddy or marshy flats emerging during low tide and submerging during high tide as intertidal zone.
- **THE SEDIMENTS** in tidal flats can be brought by the deposition processes of weathering products originated from the hinterland by the main rivers and in the brackish to marine deposits zone. But the most of sediments of tidal flats have not been cemented and consolidated into bedrock.

OBJECTIVES

- The aim of this investigation is conducted to obtain fundamental clues for proper management practices for reclaimed flat tidal soils which is highly saline and sodic or acidic sulfate soils depending on geologic locations.
- To achieve this goal, we tried to identify the basic mineralogical characteristics of soil samples taking from various areas of reclaimed flat tidal soils at Haenam Bay located at the southwestern coast line in Korea

MATERIALS AND METHODS

- Soil samples : saline-sodic and acidic sulfate soils, upland soils from Haenam Bay
- Mineralogical characteristics : XRD, SEM, and SEM-EDS, and ICP-OES for inorganic cations and heavy metals.

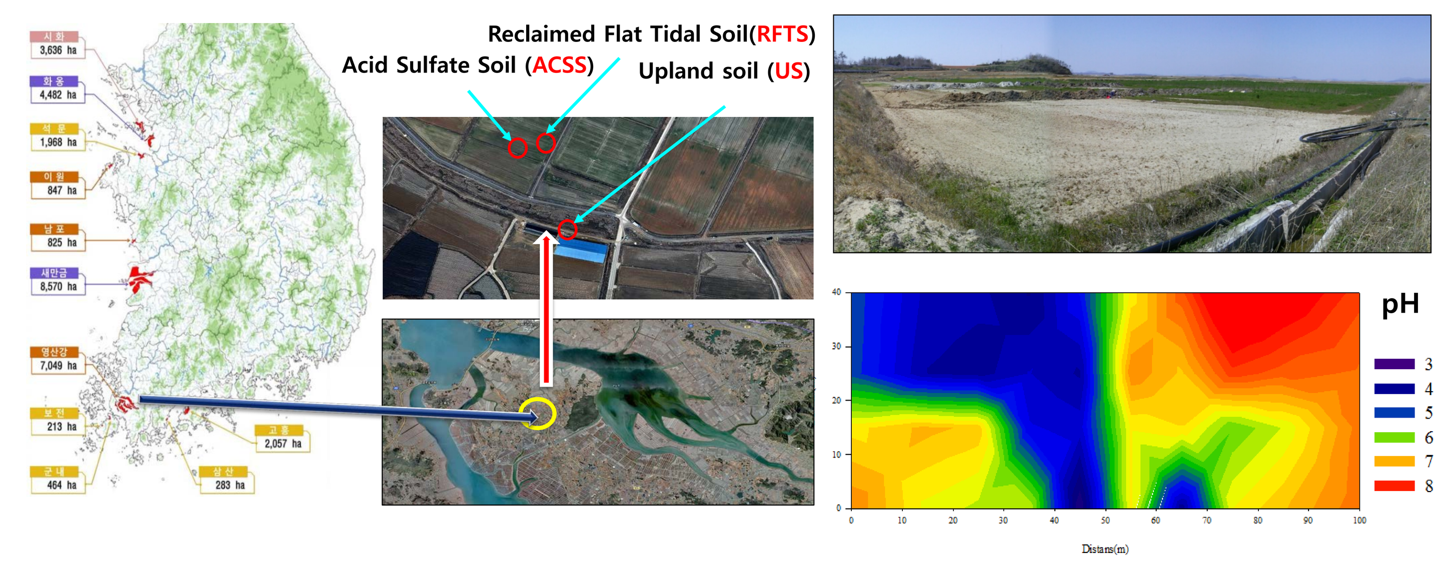


Fig. 1. The experimental site and index map of Haenam Bay along the south-western coast in Korea (right) and contour graph of EC and pH distribution (left botton) at experimental site located Haenam Bay.

RIGAKU, D/max 2500 Powder XRD

FEI, FEG SEM-Magellan400 with EDS

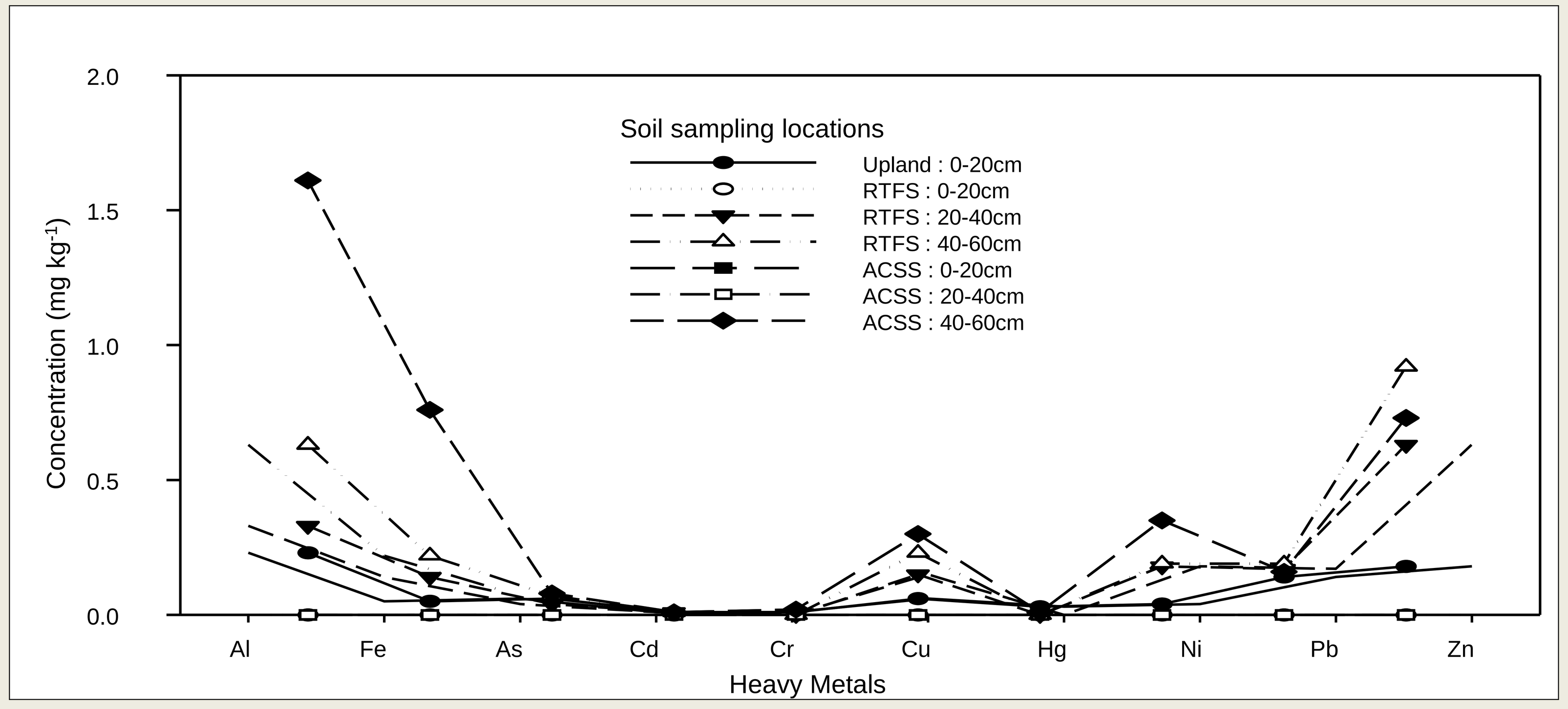


Fig. 2. Heavy metals recovered from exchangeable sites of three different depths for from 0 to 60 c m at 20 c m interval for US, RTFS, and ACSS. Exchangeable ions were obtained by 0.1N ammonium acetate extraction for all soil samples.

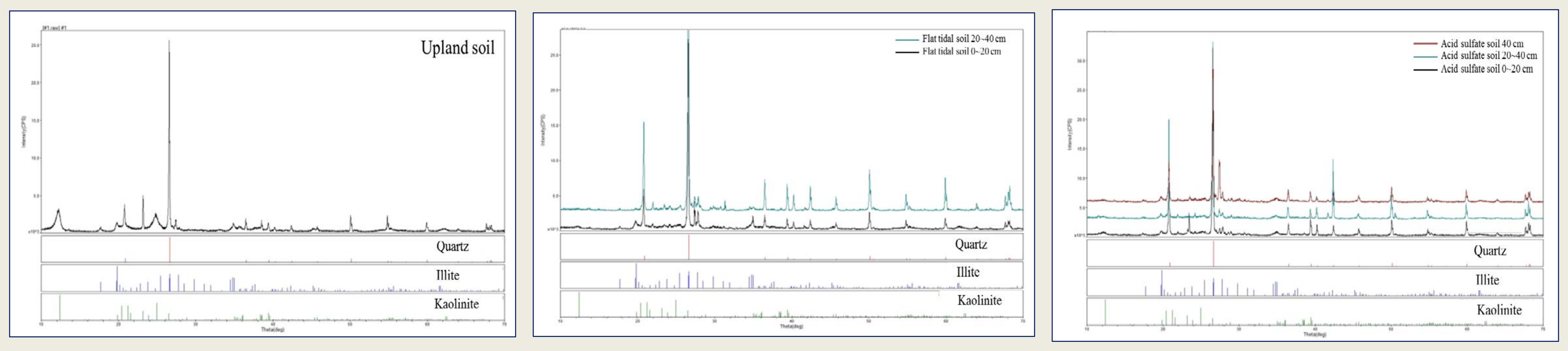


Fig. 3. XRD patterns of a representative soil sample for US, RTFS, and ACSS. The intensity of the bulk sample is magnified. Abbreviations : I–illite; K–kaolinite; Q–quartz;

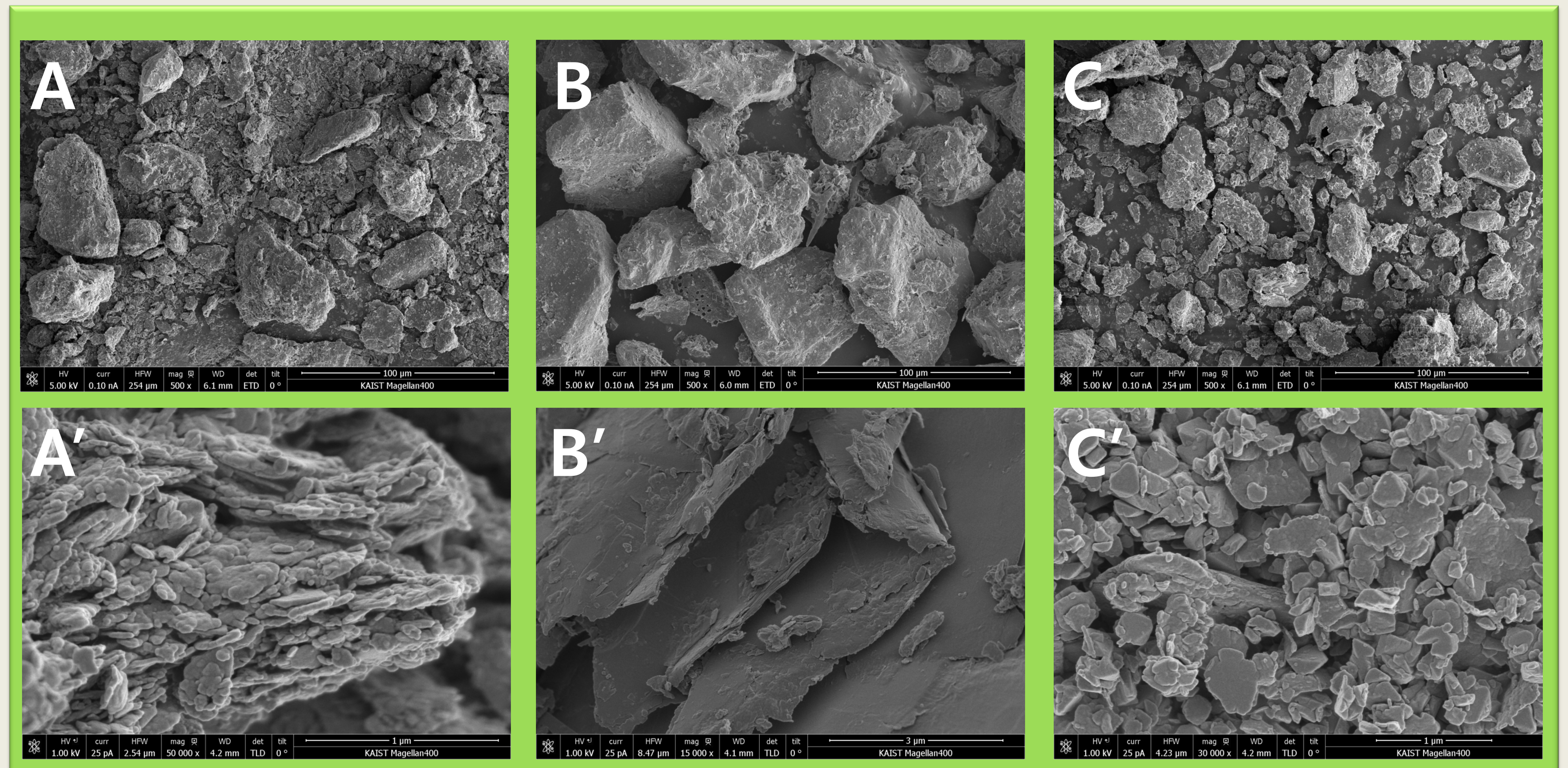
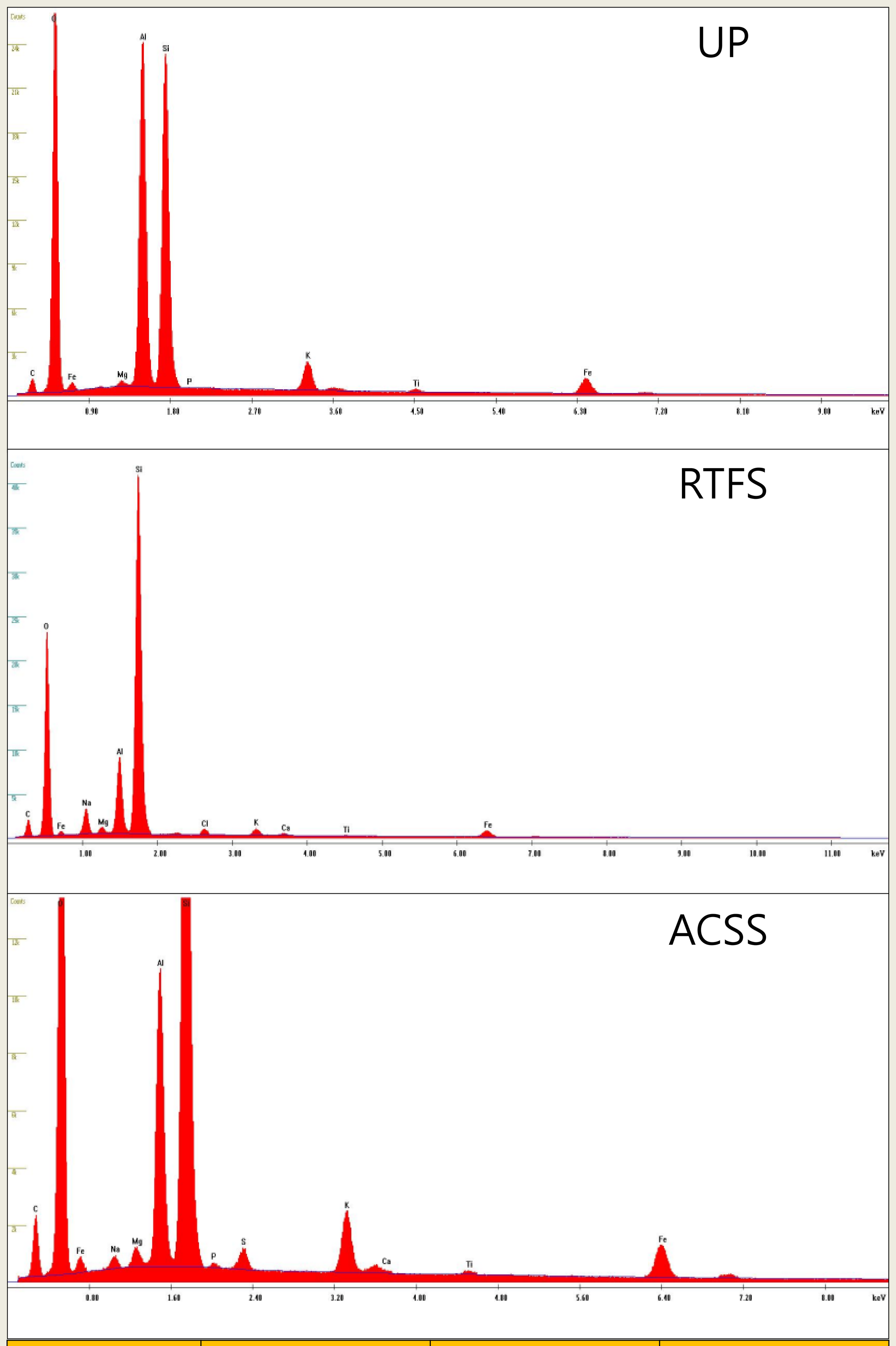


Fig. 4. Pairwise SEM backscatter images of particles of US, acid sulfate soils (ACSS) and reclaimed tidal flat soils (RTFS). Images of A to C and A' to C' show surface morphology of 500 and 50,000 magnification .



Element	UP	RTFS	ACSS
	Wt %		
O	43.7	39.7	41.1
Na	-	0.49	0.76
Mg	0.44	1.63	0.85
Al	20.9	13.5	11.1
Si	26.1	28.0	32.8
P	0.11	0.62	0.31
S	-	2.92	2.54
K	3.28	1.31	3.98
Ca		0.99	0.21
Ti	0.45	0.74	0.45
Fe	4.49	10.0	6.21
Total	100	100	100

Fig. 5. The heterogeneous soils, material containing a large particle size distribution, were analyzed by SEM-EDS to determine its morphological characteristics and the element contents.

RESULTS AND DISCUSSION

Table 1. Physical and chemical properties of upland soil (US), acid sulfate soils (ACSS) and reclaimed tidal flat soils (RTFS)

Soil samples		pH	EC ($dS\ m^{-1}$)	OM (%)	CEC ($cmol_c\ kg^{-1}$)	Particle-size distribution(%)			Exchangeable cation ($cmol_c\ kg^{-1}$)			
Location	Depth (cm)					Sand	Clay	Silt	Na	K	Ca	Mg
US	0 ~ 20	6.14	0.83	0.83	9.9	40.2	27.3	32.5	0.12	0.40	6.03	0.87
RTFS	0 ~ 20	6.64	1.86	1.86	10.2	39.1	19.2	41.7	1.31	0.37	1.32	1.01
	20 ~ 40	7.12	1.56	1.26	10.4	44.2	19.5	36.4	1.23	0.69	2.86	1.23
	40 ~ 60	7.12	1.63	1.06	10.6	43.6	19.8	36.6	1.49	0.59	3.12	1.27
ACSS	0 ~ 20	3.09	4.77	1.77	11.1	45.0	16.2	38.8	0.21	0.48	5.77	1.32
	20 ~ 40	3.76	5.65	1.35	10.6	46.6	17.9	35.5	0.33	0.25	1.39	2.04
	40 ~ 60	3.59	4.84	0.94	11.8	45.0	21.0	34.0	0.11	0.09	2.52	0.93

CONCLUSION

- pHs of the acidic sulfate soils were much lower that those in RTFS and UP due to presence of pyrite.
- Aluminum(Al^{3+}) was the most abundant cation for all three soils of RTFS, AS, and UP, especially in AS.
- There were Illite [$K(Al_4Si_2O_9(OH)_3)$] and Quartz (SiO_2) in saline-sodic and acidic sulfate soils while there were Kaolinite [$Al_4(OH)_8(SiO_{10})$], Illite [$K(Al_4Si_2O_9(OH)_3)$], and Quartz (SiO_2) in upland soils.
- Al content were slightly higher by 7 % in upland soils than that in acidic sulfate soils while Si was higher by 6 % in acidic sulfate soils, especially in AS.

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