Summer 2000 Field Activities: ATLAS Soil Organic Matter Group C.L. Ping

Dalton Highway Toolik Field Station

Summer 2000 fieldwork was conducted at study sites along the Dalton Highway from Prudhoe Bay to Coldfoot. Each of seven sites were visited three times during the periods of 6/21 26, 7/16 30 and 8/25 9/1, 2000. Study sites were located at Betty Pingo (MNT), Dalton Highway mile 411 site, 1995 Sagwon Hills Flux site #3 (MNT), Sagwon Hills DH mile 351.5 (MAT), Happy Valley 1995 Flux site, Toolik Lake tussock tundra, and Coldfoot boreal forest. Site studies were in conjunction with two different projects, the ATLAS soil organic matter study and the USDA-NRCS Hydric Soils study (Chien-Lu Ping PI). During each site visit soil properties were measured at three microsites either micro high, low and intermediate at the site or in the case of sites with frost scares, microsites with varying degrees of vegetative cover. Measurement were made at 5 cm increments including depth to frost, soil temperature, water content, presence of reduced iron, ORP electrode readings, and field-moist pH. During the August visit bulk samples were collected at the Betty Pingo, DH 411, Sagwon Mnt, Sagwon MAT, Happy Valley and Toolik Eriophorum tussock sites for inclusion in laboratory low-temperature respiration tests as augments to samples collected on the ATLAS western transect. Four undisturbed monoliths (10 x 10 x 60 cm) were collected from the Betty Pingo MNT for laboratory temperature-respiration studies.

Water-soluble soil organic matter was sampled from three sites at Toolik Lake throughout the summer season. Sampling dates were 6/24, 7/18, and 8/29, 2000 with one site also sampled preseason on 4/30, 2000. Sampling sites were:
1). under the influence of the snow fence,
2). just out of the snow fence influence, and
3) - at the soil monitoring site near the LTER site.
Three microsites were sampled at each of the three main sites with either two to three depths sampled including the thawed organic, thawed mineral and frozen mineral for each microsite. Samples were extracted and filtered on site for transport back to the lab in Palmer where SOM characterization was performed.

Quartz Creek Serward Peninsula

Soils of the Quartz Creek study area and the Council Barren site were examined and sampled from 7/28 8/1, 2000. Ten sites were examined and a total of 32 bulk soil samples were collected as part of laboratory soil respiration trials and 40 samples were collected for soil physical and chemical characterization. During the first two days, soils of the Walker vegetation grid plots in the Mauze Creek drainage were examined, the Council Barren site was visited by helicopter the third day, and the Hinzman tussock plot and Mauze Creek solifluction lobes were examined the third and fourth days.

Mauze Creek Tussock Tundra: The Tussock tundra plot is located about mid-slope in the Mauze Creek drainage. Soils at this site exhibited a similar horizon sequence in soil profiles across the plot from the upper to the lower slope position. Soils were 10 to 15 cm of organic horizons over organic enriched mineral horizons of silt loam texture. Discontinuous pockets of charcoal and

charred organic materials are present at a 5 cm depth. The upper 10 to 25 cm of mineral soils contained organic matter as a result of cryoturbation and slope movement. Seasonal frost was at 25 to 30 cm. Preliminary estimates show soil carbon stores in the Tussock plot to be from 38-42 kgC m^{-2} to a 50 cm depth with 60 to 80% of the C-stocks in the cryotubated mineral horizons.

Mauze Creek Lichen Stripes: Soils of the Walker lichen stripe plot were examined both in the lichen stripe and in the inter-stripe area. In the lichen stripes there are 0-3 cm of organic mixed with mineral soil over gravelly silt loam intermixed with a heavier textured gravelly loam soil low in organic matter. The inter-stripe soils have a thicker organic layer 5-8 cm that is continuous between stripes. The organic layer is underlain by a silt loam to loam mineral horizon that is higher in gravel content 20-40% compared to the stripe area 3-5% gravel. Seasonal frost was greater than 80 cm for the site. Preliminary estimates of C-stocks for this plot are 6 kgC m^{-2} and 12 kgC m^{-2} to 50 cm for the stripe and inter stripe areas respectively.

Mauze Creek Shrub Site: Soils of the shrub site have thin organic horizons (2-4 cm) over 10 cm of silt loam B horizon over an 8 cm layer of mixed silt loam - sandy loam B horizon that contains lenses of organic enriched A material. The finer textured surface horizons are over gravelly sandy B and C horizons. Shrub site soils are as a result of materials mixed by a combination of slope movement and fluvial - colluvial processes. Seasonal frost was below 100 cm. In contrast to the shrub areas, the transition to shrub or open shrub-meadow areas on the slopes immediately above the shrub sites have thick organic layers (18 cm) over silt loam B horizons with little gravel to 30 cm and below 30 cm cobble sized angular shist is encountered. Seasonal frost was at 30 cm in the transition areas. Preliminary estimates indicate C-stocks for the shrub soils are 12 kgC m^{-2} while stocks in the transition meadows are 21 kgC m^{-2}, each to 50 cm.

Mauze Creek Solifluction lobes/meadows: Examination of soils in the large meadows/solifluction lobes above the shrub site and in the shrub covered lower end buttrus of the lobe yielded essentially the same estimate for C-stocks as in open shrub meadows 20 kgC m^{-2} to 50 cm. Preliminary results indicate that for the upper 5-10 cm layer of mineral soils, carbon enrichment, and the presence of significant amounts of volcanic ash, have resulted in relatively low bulk density, and higher water contents properties both of which could facilitate slope movement in these soils. These soil characteristics are present in the upper soil mineral horizons in both the solifluction lobes and in the shrub areas immediately below exhibit these properties.

Hinzman Tower Tussock tundra site (Kougaruk R.): Tussock tundra soils were examined at the Hinzman tower site located opposite the camp on a large gentle slope above the Kougaruk River. Soils of this site have 15 cm of organic horizon over a loam textured Bg mineral layer. Organic enriched A material is mixed in with the Bg as a result of cryoturbation. Discontinuous bands of charcoal and charred organic fibers are present at 3-5 cm depth and in places, remnants of an old tussock surface are evident at this depth. Cracks at the surface extend into the Bg horizon that contains ice veins throughout (1-5 mm wide). Seasonal frost was at 25 cm. Preliminary estimates of C-stocks are the same as at the Walker Maus Creek tussock plot at 40 kgC m^{-2} to 50 cm.

Council Barren Site: Soils on both the acidic (schist parent material) and nonacidic (limestone) sides of the site were examined. The acidic surface is covered with 30 cm diameter sorted circles. Decomposed schist bedrock is at 38 cm and all soil horizons are 50% or more gravel. Soil over

the schist has up to 3 cm of surface organic litter under the more densely vegetated patches with 2-3 cm of organic enriched mineral AB horizon continuous across the profile. At a depth of 5 to 30 cm there is a B horizon with lenses of organic enriched A horizon mixed throughout as a result of cryoturbation. At 30 to 38 cm there is a nearly continuous layer of dark organic enriched A horizon overlying brightly colored bedrock schist that is decomposing in-place. The preliminary C-stocks at this site are estimated at 11 kgC m^{-2} to 50 cm.

Soils of the nonacidic side of the site have only scattered patches of vegetation with a limestone pavement surface consisting of weathered flat cobbles and gravel. There are up to 3 cm of organic litter under the vegetation patches (approximately covering 20% of the surface). Coarse fragments occupy 70% of the upper 24 cm the depth at which limestone bedrock is encountered. There is an AB horizon from 0 to 3 cm under the surface with a silty sand texture. Preliminary C-stocks at this site are estimated at 6 kgC m^{-2} to 50 cm.