Soil sampling expeditions are a great break in the routine of soil mapping and a wonderful opportunity to share ideas and concepts with coworkers, visiting personnel, and other specialists. The process of soil sampling in the interior of Alaska is similar to the process in more temperate climates, but there are some unique differences. The majority of the soils in this area are Gelisols, soils that have permafrost (are permanently frozen) within 100 cm or show evidence of frost churning or ice segregation within 100 cm of the soil surface and have permafrost within 200 cm (Soil Survey Staff, 1999). The cryogenic process is the dominant soil forming factor and plays an important role in soil survey land use interpretations (Tarnocai, 1994). The scientist must determine the texture, rock fragment content, and mineralogy of the mineral material within these frozen soils. Also, the ice content of these soils is highly variable and must be determined because it affects the degree of soil subsidence if and when these soils thaw.

Gelisols are much more complex than simply a mixture of inorganic components, organic materials, and ice. The ice in these soils varies in form from small lenses to car-sized wedges. The permafrost in Central Alaska is near the freeze–thaw point, and has a variety of deformational mechanisms that result in subsidence, shear stress, or ice creep under very small loads (Williams and Smith, 1989).

The zone that freezes and thaws annually, typically the zone between the soil surface and the top of the permafrost, is called the active zone. The active zone has many important roles. It is the zone of virtually all biotic activity (e.g., plants, animals, and microbes) in these soils. It is also the zone having the most pedogenic processes (cryoturbation, redox, etc.). More recently, it is being studied as the conduit between the permafrost and the atmosphere. Very slow pounds are reintroduced into the atmosphere. This process may have a reinforcing effect on global warming.

The depth to permafrost is greatly increased when these soils are cleared and the insulating mat of organic materials is removed for cropland or pasture. This increase in depth to permafrost is beneficial for such uses, but many structural problems result when the permafrost thaws beneath buildings, roads, and other structures. In the article, we outline some of the interesting and challenging problems faced by soil scientists in Interior Alaska as they dig, describe, and interpret the field and laboratory data from these frozen soils.

Field Logistics

Getting from the staging area to the sample site can be an adventure when sampling permafrost soils in the Alaskan bush. It is routine to carry 50 to 60 lb. of equipment through dense forests, ponded areas, and clouds of mosquitoes. The group must also consistently make enough noise to ensure the sampling party does not surprise large, unsuspecting wildlife.

Excavating pits in permafrost is very difficult. Gas-powered augers and jack hammers are used to facilitate digging in permafrost. Access for conventional backhoes for excavation is limited by dense forest vegetation, microtopography, soil wetness, and low soil strength (Fig. 1). All terrain