Editor’s note: This is the second in a two-part series on Gelisols. Part I (https://www.soils.org/publications/sh/articles/54/3/sh2013-54-3-gc) examined the cryogenesis and the state of formation, and part II looks at classification and related issues.

In North America, permafrost-affected soils were first studied by J. Tedrow followed by K. Everett, J. Brown, and J. Drew during their expeditions in the Arctic and Antarctica beginning in the 1950s. W. Pettapiece, C. Tarnocai, S. Zoltai, and their colleagues have been investigating these soils in arctic Canada since the 1970s. They all recognized the cryoturbated soil profiles in association with patterned grounds. The cryogenic nature of these soils was recognized and built into Soil Taxonomy (1975) in which soil climate became an important taxonomic differentia.

Cold soils with mean annual soil temperature (MAST) at 50 cm <8°C were classified at the cryic great group, and soils with MAST <0°C were placed at the pergelic subgroup. When S. Rieger worked on the exploratory soil survey in arctic Alaska in late 1960s, he observed some soils with broken surface organic horizons across the nonsorted circles. Thus, he introduced the taxa of Rupctic-Histic Pergelic Cryaquepts for those cryoturbated soils formed in tussock tundra with permafrost. But soil scientists soon realized that “pergelic” soils cannot be consistently mapped because some soils have MAST <0°C without permafrost. To fill the gaps of knowledge in permafrost-affected soils, Rieger did a thorough literature review on cold soils and summarized the results in his monumental publication The Genesis and Classification of Cold Soils by Academy Press (1982). In this book, Rieger summarized the thermal regime, cryogenesis and cryoturbation in cold soil formation, and classification according to Soil Taxonomy (1975). In this book, Rieger also thoroughly reviewed Russian literature on cold soils, which was scarcely known to the Western scientists at that time. For the first time, Rieger delineated the soils affected by permafrost (pergelic subgroups) in the Exploratory Soil Survey of Alaska (1975), which served as the basis for the later STATSGO mapping of Alaska.

In the past decades, scientists involved in the National Science Foundation-funded Arctic program have focused on the arctic tundra ecosystem because of its role in the global C cycle. The research programs have further advanced the knowledge on permafrost-affected soils, and the need for a separate order for these soils was brought to the forefront. Then an opportunity presented itself during the National Cooperative Soil Survey (NCSS) conference in Corpus Christi, TX (1988) when I asked Tarnocai about his Cryosol research in Canada, and he agreed to host a collaborative Cryosol study trip transecting from the Yukon to Northwest Territories joined by the USDA-NRCS and University of Alaska–Fairbanks in 1989. This project provided the first sample set of permafrost-affected soils to the USDA National Soil Survey Center and served as the core database for the 1993 International Soils Correlation on Permafrost-affected Soils in which scientists from seven countries participated in a field excursion from Inuvik to Fairbanks to review and discuss the genesis and classification of those cold soils.

During the conference, the development of the Gelisol order was discussed among the group, the precursor of the Cryosol Working Group, which continues to be active under the auspices of the International Union of Soil Sciences (IUSS) and the International Permafrost Association (IPA). However, the stage for international cooperation on cold soils research was set even earlier when the pedologists from Alaska-Yukon and northeastern Russia exchanged field visits in the summer of 1992. The joint U.S.–Russia Seminar on Cryopedology and Climate Change in