"For a long time it was believed that the Italian 'amianti' were all the tremolite type because the first examinations of the material were based on samples of tremolite. It was only in recent years that, after further studies, the producers recognized that their products were for the most part chrysotile with a long, flexible fiber."

Tremolite asbestos has been mined in the Natal, South Africa, where it occurs in green talcose rocks — probably altered ultramafic rocks similar to those of the Jamestown Series in the Barberton district of South Africa (Hall, 1918, p. 109). In the United States tremolite asbestos has been mined in small quantities near Powhatan and Pylesville, Maryland, where it occurs in amphibolized ultramafic rocks. Anthophyllite asbestos also occurs in these same rocks.

Actinolite, amosite, and crocidolite asbestos

Commercial mining of actinolite asbestos is practically unknown. No mining of amosite asbestos occurs outside the Transvaal. In the past crocidolite was mined in the Cochabamba, Bolivia, from rocks of igneous origin.

MAJOR OCCURRENCES OF CHRYSOTILE ASBESTOS

The commercially most important form of asbestos, chrysotile, is found in three distinct types of deposits: (Type I) alpine-type ultramafic rocks, including ophiolites, (Type II) stratiform ultramafic intrusions, and (Type III) serpentinized limestones. Type I deposits are by far the most important, furnishing at least 85 percent of the world's chrysotile fiber. Type III deposits are relatively unimportant but do furnish some high quality fiber.

Type I deposits

One example of a Type I deposit has already been discussed, the Pankkila and Maljasalmi fields of East Finland. In these deposits, however, the valuable asbestos mineral is anthophyllite, not chrysotile.

The two most important asbestos producing localities in terms of production, past and present, are the serpentinized ultramafic rocks of the central and southern Urals and of the Appalachian Mountains in

southeast Quebec and northern Vermont. The Russian and North American occurrences are similar; the serpentinites are of the alpine-type and part of ophiolite sequences (Coleman, 1977).

The chrysotile asbestos deposits of Quebec, and their extension into northern Vermont, occur in altered peridotites, which form part of an ophiolite suite of rock types. Included in this suite, in addition to the peridotites (dunites and harzburgites), are gabbro cumulates, diabase sills, tholeiitic pillow lavas, and red argillites. These units were emplaced tectonically into the country rocks in early Ordovician time. The peridotites, regarded as fragments of oceanic crust and mantle, are suggested to have undergone the following sequence of events: (1) the formation of peridotites in an oceanic environment through lithosphere accretions and sea-floor spreading; (2) the fragmentation and tectonic emplacement; and (3) deformation of the ultramafic rocks within the Cambro-Ordovician country rocks (Laurent and Hébert, 1979). These same authors propose that serpentinization occurred in two stages: (1) early serpentinization in an oceanic environment at low temperatures, where lizardite was the principal serpentine mineral, and (2) late serpentinization in a dynamic regime of tectonic transport and emplacement, where fracturing of the peridotite masses took place. Chrysotile asbestos formed in these late-stage fractures, probably in a stress environment.

Chrysotile-bearing serpentinites form a part of a discontinuous belt of ultramafic bodies and associated rocks extending for almost the entire length of the Appalachian Mountain chain. The major and active chrysotile deposits are, however, centered in Quebec in the towns of Black Lake, East Broughton, Thetford Mines, and Asbestos; smaller active deposits are at Baie Verte, Newfoundland, and Eden Mills, north-central Vermont. Further south in the Appalachian Chain, the ultramafic bodies generally contain only small amounts of chrysotile; thus, only minor production of this fiber, with the exception of the Vermont Asbestos Group operation at Eden Mills, has occurred in the eastern United States. As already alluded to, these ultramafic rocks in Maryland, Virginia, North Carolina, and Georgia have been the sources of minor amounts of anthophyllite and tremolite asbestos.

The Quebec chrysotile deposits were first discovered in 1877 in the