and (4) serpentinized limestone (chrysotile). Of these, the banded ironstones of South Africa and Western Australia and the alpine-type ultramafic rocks of East Finland are or were the only major sources of amphibole asbestos.

Amosite and crocidolite in ironstones of South Africa

The mining of amphibole asbestos is now essentially confined to South Africa.[4] The amosite and crocidolite asbestos occur in the banded ironstones of the Transvaal Supergroup, a thick succession of Precambrian sediments (~ 2200 m.y., Truswell, 1977, p. 42) with widespread outcrops in the Transvaal and Cape Provinces and in southeastern Botswana. The two asbestos producing localities are the *Transvaal Asbestos Field* in the north-central part of the Transvaal Province and the *Cape Asbestos Field* in the northern Cape. At present about 200,000 tonnes of amphibole asbestos are produced yearly from these two fields.

Transvaal Asbestos Field. This field stretches from Chuniespoort easterly to beyond Penge, Transvaal Province, a distance of about 100 km (Fig. 3). Most of the amosite presently mined is derived from the Penge area, about 80 km north of Lydenburg. Minor amounts of amosite and crocidolite are mined intermittently in the Chuniespoort-Malips Drift area to the west of Penge (Dreyer and Robinson, 1978). The Penge area is sometimes referred to as the "Lydenburg asbestos field" and the Chuniespoort-Malips Drift area as the "Pietersburg asbestos field."

In the Transvaal the rock members of the Transvaal Supergroup consist essentially of quartzite, shale, dolomite, and conglomerate at the base (Wolkberg Formation, Black Reef Series), dolomite, banded ironstone, and shale in the center zone (Dolomite Series); and quartzite, shale and hornfelses at the top (Pretoria Series). The asbestos-bearing rocks lie within the Banded Ironstone Stage of the Dolomite Series (Fig. 3). These rocks have been intensely folded along two major fold axes (Dreyer and Robinson, 1978), the folding predating the deposition of the Pretoria Series. The banding within the ironstones is fine and regular; the

[4] Small amounts of anthophyllite and tremolite asbestos come into the international market sporadically, at most a few thousand tonnes a year. These types of fiber are generally from small, marginally profitable, deposits.

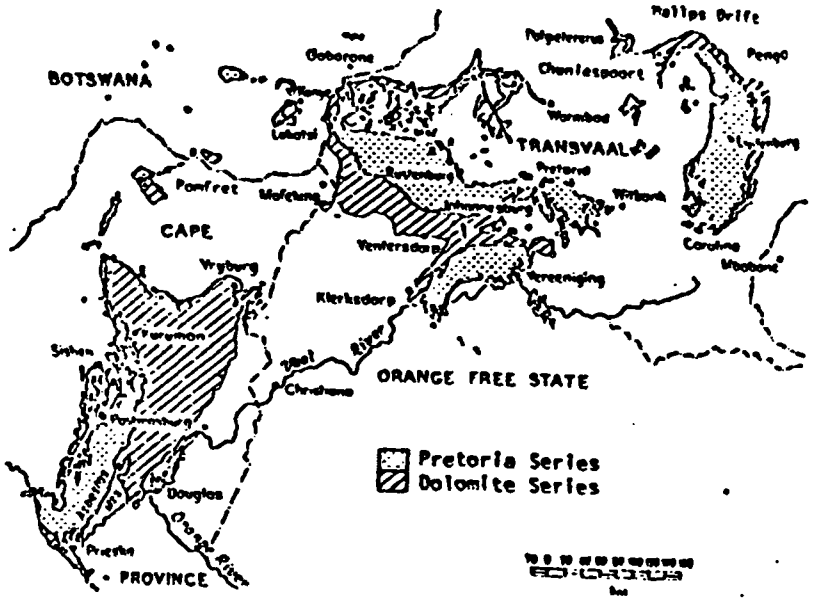

Figure 3. Index map of the crocidolite and amosite asbestos-bearing iron formations of the Transvaal and Cape Provinces of South Africa. After Truswell (1977).

light colored bands consist of chert with some siderite, the dark bands of magnetite and grunerite. Within the banded ironstone sequences the asbestos-bearing seams occupy definite stratigraphic horizons, generally known as the Lower Zone, the Main Zone, the Short Fibre Zone, and the Upper Zone. Some intermediate zones are developed locally. Each zone consists of a large number of individual fiber seams or groups of seams which are given local names (Coetzee *et al.*, 1976). In the Pietersburg asbestos field amosite and crocidolite are sometimes observed occurring in adjacent seams (Hall, 1930, Fig. 38, p. 212). East of the Mohlapitse River, crocidolite decreases rapidly, so that only amosite is found in the Lydenburg asbestos field near Penge.

Within the Transvaal Province there is evidence of thermal metamorphism of the Transvaal Supergroup rocks as a result of the intrusion of the Bushveld Igneous Complex. For example, the shales of the Pretoria Series overlying the banded ironstones were recrystallized to hornfelses, scapolite appears in the dolomites underlying the ironstones, and amphibolization took place throughout most of the banded ironstone sequence. Crystallization of the amphibole asbestos, however, took place after