from pyrrhotite through oxidation; and pyrite IV evolved from pyrrhotite in a reaction involving marcasite I as an intermediate product.

Magnetite may also be divided into magnetite I, a metamorphic variety; magnetite II, a by-product of pyrrhotite oxidation; and magnetite III, an oxidation product of some supergene sulfides.

There are two generations of marcasite: marcasite I, originating through the pyrrhotite reaction mentioned above and occurring as concretions or veinlets of amorphous to crypto-crystalline nature, and marcasite II, which is found as crystalline aggregates on edges of pyrite III or pyrite IV but not on pyrite I and pyrite II. The second generation is apparently pseudomorphic after pyrite, which, to the author's knowledge, has neither been produced in the laboratory nor reported previously in ores.

The genetic and textural relations displayed by the ore minerals indicate that an iron formation originally containing sedimentary sulfide-carbonate mineral assemblages was profoundly modified through subsequent metamorphic and supergene events.

MINERAL LINEATION AND "TECTONIC TRANSPORT" IN COLDBROOK ROCKS, BEAVER HARBOUR, NEW BRUNSWICK

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Low-grade metamorphic rocks of the Precambrian(?) Coldbrook Group contains a steep plunging lineation which has regional significance in the Beaver Harbour area.

The lineation is synkinematic with the first and main deformation of the metavolcanic sequence. It is expressed by prismatic actinolite in the basic rocks. Interlayered quartzo-feldspathic rocks show blastoporphyritic felspars with trails of recrystallized minerals in the same orientation as the *c*-axes of the actinolites. Plunges of mesoscopic folds are either parallel to the lineation or have shallower attitudes in the plane of schistosity.

The combined fabric of actinolite, quartz, and mica has orthorhombic symmetry.

The ambiguity regarding the tectonic significance of lineations can be solved for the area studied by a combination of kinematic and dynamic inferences based independently on the observed microscopic fabric of the rock. A kinematic interpretation of the different subfabrics applying Flinn's L–S system allows conclusions about the possible orientation of the principal strain axes. It is established that the lineation is parallel to the longest axis (Z) of a triaxial deformation ellipsoid. The intermediate axis (Y) has also undergone elongation. The lineation is therefore the maximum extension direction but not a single transport direction.

The fabric is also compared with mineral orientations expected from recent thermodynamic models of mineral crystallization under non-hydrostatic stress. The strain ellipsoid derived by kinematic inferences can be related to stress axes using Kamb's theory.

SECTOR ZONING IN STAUROLITE, KWOIEK AREA, BRITISH COLUMBIA

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Electron microprobe analyses of a staurolite crystal from the Kwoiek area, British Columbia, a contact metamorphose terrain associated with the Coast Range Batholith, showed that it contains three distinct compositional sectors. Each staurolite sector consists of those parts of the crystal that grew in the [001], [010], or [110] directions. Analyses for the five elements Fe, Mg, Si, Al, and Ti were performed at 10 micron intervals in two crystallographic directions across each of six successive thin sections perpendicular to the *c*-axis of the staurolite crystal.

The chemical characteristics of the sectors are as follows: [001] has relatively high Al and relative low Si, Ti, and Mg (analysis 1); [010] and [110] have relatively low Al and relatively high Si, Ti, and Mg (analyses 2 and 3). [110] differs from [010] in having Ti increase continuously from the center to the edge, whereas in [010] (and [001]) Ti is nearly constant throughout the sector. Mg decreases from center to edge, and Al, Si, and Fe are nearly constant within each sector. The [010] sector has higher optical absorption than [110] and [010]. Trace amounts of Cr are present at the edge of the [010] sector but nowhere else in the crystal. The analyses are based on correction factors of Bence and Albee.

	#1 [001] sector	#2 [010] sector	#3 [110] sector
SiO_2	25.96	27.66	27.50
TiO_2	0.32	0.64	0.46
Al_2O_3	55.93	53.57	53.82
FeO	14.07	13.98	13.84
MnO	0.19	0.17	0.16
MgO	1.99	2.11	2.13
ZnO	0.2	0.2	0.2
Total weight % (less H_2O)	98.66	98.33	98.11

Several important petrologic conclusions can be made from the observations: (1) crystallographic growth directions in a rock-forming mineral, even in a metamorphic environment, can produce compositional differences within a single crystal. (2) Si–Al substitution in the tetrahedral site is present. (3) Charge inconsistencies between one sector and another suggest that hydrogen may also be sector-zoned in the staurolite.

Analyses of other staurolite crystals from the Kwoiek area and at least one staurolite crystal from New Hampshire indicate the observed compositional phenomenon is not unique to the investigated crystal. Similar sector zoning has aso been recognized in andalusite from the Kwoiek area.

BERYLLIUM IN A GRANITISATION CYCLE

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During prospecting of berylliferous pegmatites near a granite contact, analytical determination of Be was extended from ore to country rocks, granites, pegmatites, and pegmatite minerals. Granite contained 2¾ ppm Be. Country rock schist—greywackes, siltstones, and shales metamorphosed up to staurolite grade—contained 5 ppm Be. Both schist and granite Be contents varied within narrow limits only. However, the granite, a late-orogenic concordant batholith, is itself composed in large part of granitised schist from the same formation as the country rock schist. The problem of what happened to half of the Be content leads to the idea of a "balance sheet". Complementary higher values of Be up to 12 ppm are found in several relatively small discordant granite, bosses (not included in the average granite) and values up to several hundred ppm Be in the berylliferous pegmatites. Abundant pegmatites near the granite-schist contact are simple in their mineralogy and contain around 5 ppm Be. In the rarer complex pegmatites farther away from the granite contact, Be was concentrated both in silicate melt and succeeding metasomatising solutions. Only in beryl-bearing pegmatites is the content of Be in other minerals, particularly muscovite and albite, significantly increased—a feature that can be utilized in reconnaissance exploration. Further work of the type outlined in this paper could usefully be done on other elements to extend the "granitisation balance sheet".