UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

A MINERALOGICAL LOOK AT THE PURPLE AND GREEN PHYLLITIC SHEARED BRECCIA FROM THE HAMMOND TERRANE, CHANDALAR D-6 BROOKS RANGE, ALASKA

by

Walter B. Friesen and David G. Howell[1]

Open-File Report 87-156

[1]Menlo Park, CA

A MINERALOGICAL LOOK AT THE PURPLE AND GREEN PHYLLITIC SHEARED BRECCIA FROM THE HAMMOND TERRANE, CHANDALAR D-6, BROOKS RANGE, ALASKA

by

Walter B. Friesen and David G. Howell
U.S. Geological Survey
Menlo Park, CA 94025

INTRODUCTION

A single sample of a purple and green phyllitic sheared breccia unit in the Hammond terrane of the Brooks Range (Fig. 1) contains large amounts of fine-grained quartz, muscovite, ankerite and trace amounts of detrital tourmaline, indicating a marine sedimentary origin. A sedimentary protolith is also supported by the occurrence of marine clays or their metamorphic equivalents, the paucity of feldspar, pyroxene, amphibole and opaque minerals as well as the absence of accessory minerals such as apatite, rutile and zircon. Subsequent low grade regional metamorphism and cataclasis have altered the deposit.

In thin section numerous pods, spindles and blocks of deformed clasts and augen are apparent and these are nearly on-end in orientation to the major foliation of the rock. On a microscopic scale, granulation of material that was probably already fine grained and metamorphic segregation layering are apparent in disrupted bands and augen of quartzitic and pelitic material (Fig. 2).

The specimen was collected one kilometer east of the haul road just north of Nutirwik Creek. Fault bounded slivers of purple and green phyllite crop out throughout the Chandalar D-6, but always in close proximity to the Skagit Limestone (Dillon, unpub. map). Based on reconnaissance mapping in the region to the east, as far as Arctic Quadrangle, similar phyllites are spatially associated with the Skagit Limestone and the overlying Beaucoup Graywacke. It is not clear how these phyllite units fit into the geologic history of the Hammond terrane. Graded bedding, turbiditic Bouma sequences and large bowling ball sized quartz clasts further suggest a marine, possibly submarine fan, origin for the purple and green units. A volcanic origin is also suggested locally for units in the Wiseman Quadrangle (Oldow oral commun. 1986) all of which points out the need for additional study of these purple and green units.

MINERALOGY

Mineralogy was determined both by X-ray diffraction of powdered whole rock and optically in thin section. A summary of the X-ray mineralogy is presented in Table 1.

TABLE 1. X-ray Diffraction Mineralogy

Quartz	Abundant
Muscovite	Common
Chlorite	Common
Ankerite	Present
Hematite	Present
Plagioclase	Present

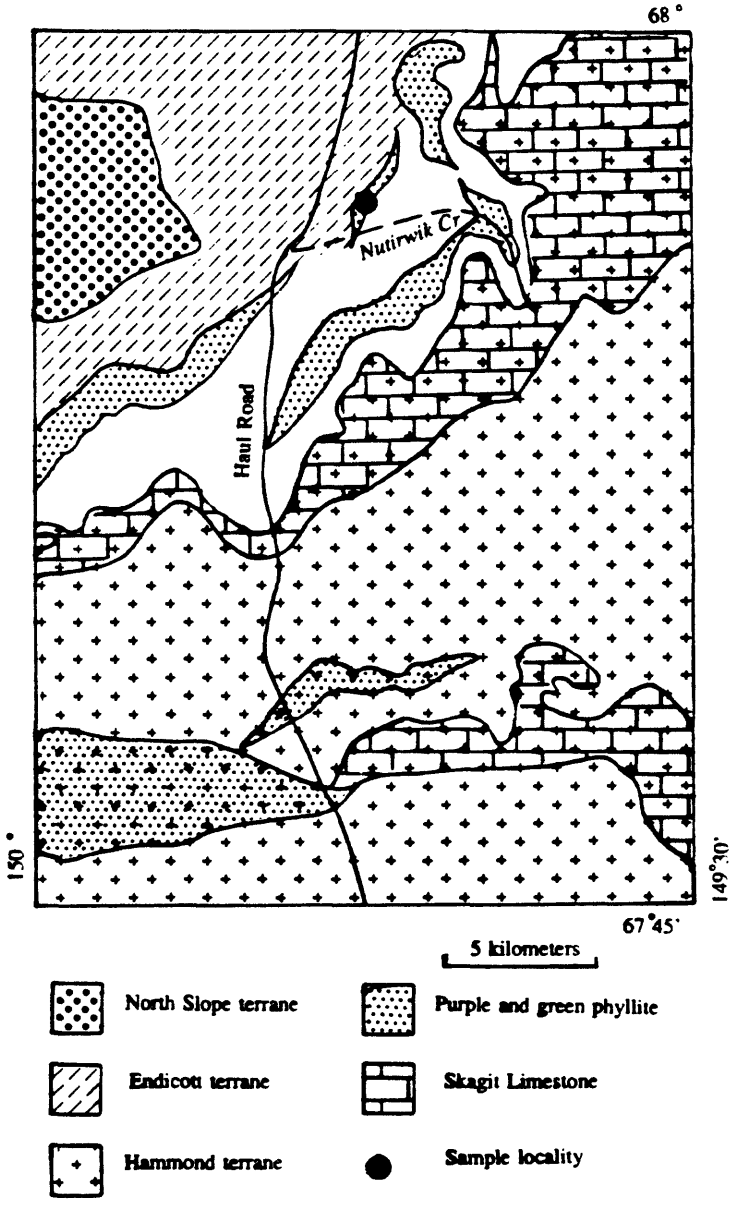

FIGURE 1. Generalized geology of Chandalar D-6 Quadrangle from John Dillon (unpub. data). All contacts are thrust faults and many more thrusts exist than shown here. The region between the Endicott and Hammond terranes is a 1- to 5-km-wide complex fault zone.

FIGURE 2. Line drawing of a photomicrograph, 1.1 mm across, displaying typical textures and mineralogy of the purple and green phyllitic shear breccia. The segregation layering is composed of chloritic pelite (dark colored) and muscovite pelite (light colored). Note the large quartz augen composed of clear quartz clasts and a matrix of muscovite plates and ankerite rhombs. This augen is deformed, bounded by a prominent flattening foliation (schistosity) inclined left to right and the shear planes (cisaillement) ca. horizontal orientation.

A thin section was cut perpendicular to the major foliation facilitating mineral and textural analyses. Table 2 presents the point counted mineralogy demonstrating the extremely discontinuous nature of the texture and composition.

TABLE 2. Point-counted modal analyses of mineral phases.
Five 100-point counts across the major foliation

Mineral Phase	Analyses				
Component	1	2	3	4	5
Quartz	20%	54%	48%	34%	34%
Muscovite	46%	14%	24%	24%	27%
Chlorite	19%	16%	22%	33%	26%
Hematite	14%	7%	---	2%	8%
Ankerite	1%	9%	6%	7%	5%
Hornblende*					
Tourmaline*					
Total	100%	100%	100%	100%	100%
*Present but at abundances too small to be represented					

Most of the quartz is anhedral, strained and displays abundant translation lamellae. Much of it is permeated with inclusions of ankerite, muscovite and chlorite. Muscovite is largely confined to the pelitic clasts occurring as fine flakes in association with chlorite and quartz. Chlorite pervades the rock, usually as intergrowths with quartz in pelite clasts. Ferroan ankerite is pervasive, locally abundant, and typically forms a rhombic habit: much of it is altered to hematite.

Disparity between the X-ray diffraction and optical mineralogy results primarily from the fine grain size of the mineral phases. Optically detected hornblende and tourmaline were seemingly too rare to register on the diffraction pattern. The large variation in composition in the clasts and augen may reflect metamorphic segregation as well heterogeneity in the original sedimentary deposit.

DISCUSSION

The paragenesis of the rock includes an initial deposition in a marine(?) environment of probable fine grained, thinly laminated strata rich in carbonate. The abundance of quartz throughout the rock coupled with the paucity of other rock forming minerals and absence of rock fragments suggest a mature, multi-cycled sediment. The provenance may have been a sedimentary terrane.

Low-grade greenschist metamorphism followed burial and diagenesis, but the timing is not known. The obvious effects of the metamorphism include the transformation of clay phases in the original sediment to muscovite and chlorite, the recrystallization and perhaps iron enrichment of chlorite and ankerite, the deformation of quartz and the generation of the various foliations.

The foregoing is a simplified and incomplete analysis of the origin and development of the purple and green phyllites in the Chandalar region of the Brooks Range. Other purple and green units crop out in the adjoining areas, and the petrogenesis of such units may be markedly different. Nonetheless, because all the purple and green units seem to track with the Hammond terrane they represent an important ingredient to the geologic history of the region, and an aspect that certainly requires more attention.

ACKNOWLEDGEMENTS

Suggestions and comments from Tom Moore, Randy Koski, Davey Jones, Clark Blake and David Clague help solidify our interpretations of this puzzling rock specimen. Field work was partially funded by USGS/DOE interagency agreement DE-AI21-83-MC20422.