GRANITOID CLASTS IN BOULDER BRECCIAS OF MACLEAN EXTENSION OREBODY, BUCHANS, NEWFOUNDLAND[1]

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Abstract

Approximately fifty per cent of the Buchans massive sulphide orebodies mined to date occurred in subaqueous breccia-conglomerate beds within an Ordovician-Silurian volcanic island-arc sequence, the Buchans Group. Amongst the diverse lithic clasts in these beds are rounded, subspherical granitoid pebbles, cobbles and boulders. An intrusive body to the southwest of the mine area, the Feeder Granodiorite, is lithologically similar to some of the granitoid clasts and has been interpreted to be comagmatic with some of the Buchans Group volcanic rocks. Twelve types of granitoid clasts were recognized based on megascopic characteristics but this number will probably be reduced after laboratory investigations have been completed.

Introduction

The volcanogenic sulphide ore deposits at Buchans occur as three types: stockwork ore, in situ ore and transported ore (Thurlow, 1981a; Thurlow and Swanson, 1981). The transported ore forms a series of sulphide-bearing breccia-conglomerate beds with diverse lithic clasts, including granitoids (i.e. plutonic rocks of felsic to intermediate composition) within an Ordovician-Silurian sequence of subaqueous volcanic, volcaniclastic and sedimentary rocks. The source of these granitoid clasts has been enigmatic. 'An intrusive body of small surface area (approximately 1.5 km^2), the Feeder Granodiorite, outcrops 12 km southwest of Buchans. It has been interpreted to be comagmatic with Buchans Group volcanics and the possible source of the granitoid clasts (Thurlow, 1981b). A description of the central volcanic belt is given in Kean et al. (1981).

It is the intent of this study to determine the petrological character, geochemistry, and age of the granitoid clasts and of the Feeder Granodiorite and shed light on the relationship of the Feeder Granodiorite to the Buchans Group and the included granitoid clasts, and in turn on the provenance and derivation of the clasts.

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Underground Observations

The transported orebodies consist of a sequence of breccias and conglomerates which are considered to show characteristics of sediment gravity flow deposits (Walker and Barbour, 1981; Binney et al., 1983). Detailed examination of those units which are relatively rich in granitoid clasts indicates that most granitoid-rich units overlie and flank the sulphide-rich breccias. Granitoid clasts, however, are found in other units not intimately associated with the sulphide-rich breccias. These granitoid clasts are typically smaller (pebble-sized) than the typical cobble-sized granitoid clasts found with the ore. Rare granitoid clasts have been found in almost all Buchans Group formations, although nowhere in significant numbers or volume as compared to the ore horizon (J.G. Thurlow, personal communication, 1982).

The nature of the granitoid clasts varies appreciably in hand specimen. A tentative field classification based on colour, grain size, presence or absence of quartz phenocrysts and mafic mineral content indicate twelve clast types (Table 44.1).

The average granitoid clast size as determined within several exposures of granitoid-bearing (arenaceous) breccia-conglomerate (see Table 44.2) on 20 level, MacLean Extension orebody, is 6.4 by 4.1 cm. The long dimensions of granitoid clasts range from 1 cm to more than 50 cm. Where intimately associated with the transported massive sulphide ore (e.g. 20-5 sublevel, 20-13 drift), average clast size is of the order of 16.5 by 10 cm and granitoid clasts comprise approximately 4 per cent by volume. In more arenaceous units, granitoid clasts average 4.2 by 2.0 cm and constitute 1 per cent of the rock. Rare granitoid clasts have been observed in tuffaceous rocks, both overlying and underlying the ore horizon. These clasts average 7.5 by 6.0 cm and comprise much less than 1 per cent.

Granitoid clasts are subrounded to well rounded and typically subspherical, although many are oval and elongate. They are consistently better rounded than other clast types in the breccia-conglomerate units.

Surface Observations

The Feeder Granodiorite is an irregularly shaped body of approximately 1.5 km^2 occurring in upper Wiley's River area (Fig. 44.1). Along its southern and western exposures the granodiorite can be seen in contact with rocks presumed to be part of the Topsails complex (Taylor et al., 1980). At the Feeder Granodiorite-Topsails contacts, Topsails granite shows a weakly developed chilled margin against the Feeder Granodiorite. Brick-red, fine grained, equigranular dykes, macroscopically similar to the Topsails granite cut Feeder Granodiorite. The granodiorite and the Topsails granite are both cut by diabasic dykes. No exposures of the contact between Feeder Granodiorite and Buchans Group rocks were found. No definite evidence of cross-cutting relationships between diabasic and granitic dykes was observed.

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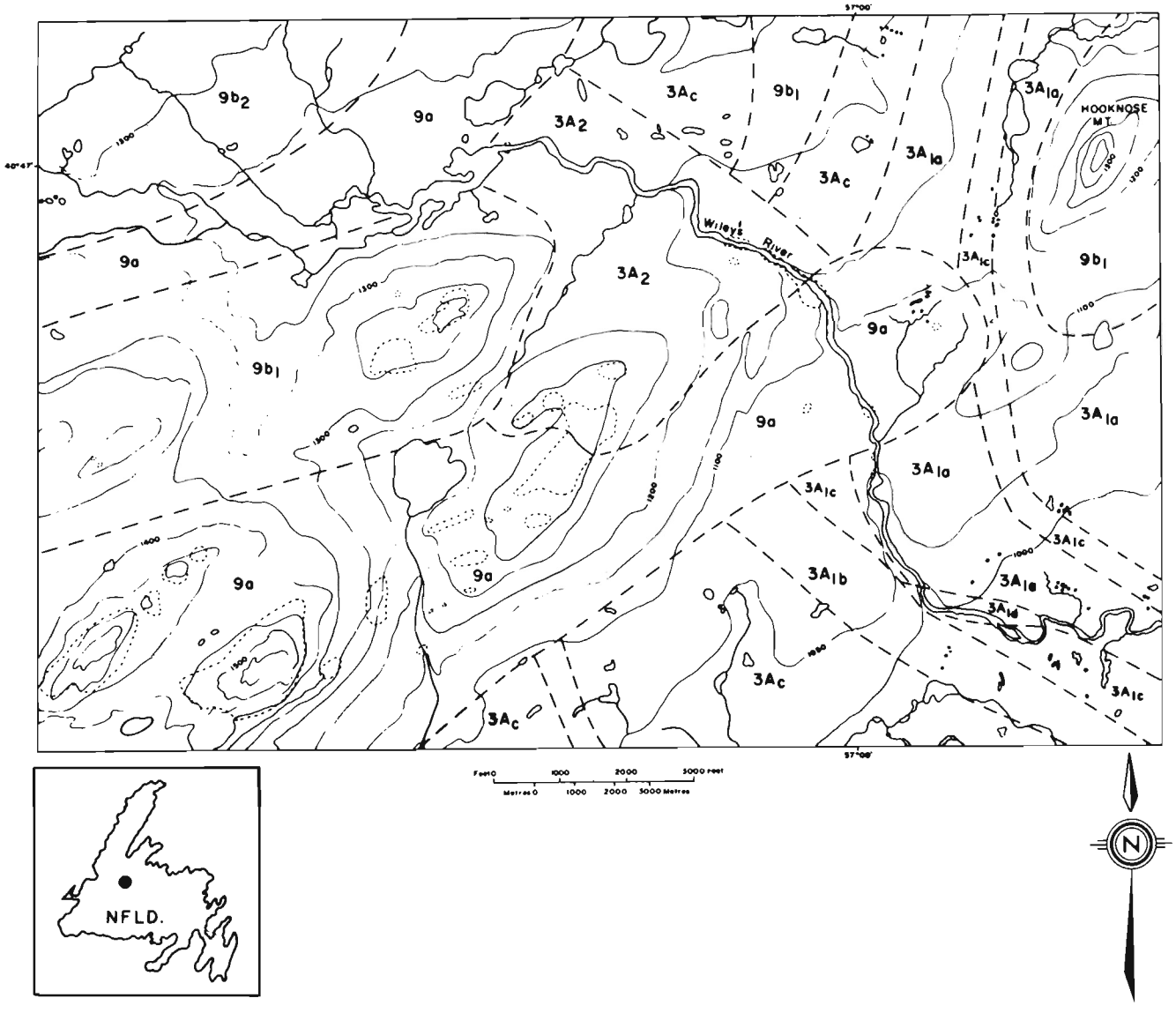

LEGEND

SILURIAN AND DEVONIAN

TOPSAILS GRANITE

9a	Alkali Feldspar granite: fine to medium grained, brick red granite
$9b_1$ | $9b_2$	Mafic Intrusives (associated with Topsails Granite): fine to coarse grained diabase ($9b_1$) and gabbro ($9b_2$).

ORDOVICIAN-SILURIAN

BUCHANS GROUP

$3A_a$ | $3A_c$	Footwall Arkose: $3A_a$, lithic arkose; $3A_c$, basaltic lava pillow lava, pillow breccia.
$3A_{1a}$ | $3A_{1b}$ / $3A_{1c}$ | $3A_{1d}$	Wiley's Prominent Quartz Sequence: Stratigraphic volcanic equivalent of 3A; characterized by quartz crystals commonly exceeding 1 cm in diameter; $3A_{1a}$, rhyolite flows and tuffs; $3A_{1b}$, dacitic pyroclastics; $3A_{1c}$, basaltic lavas, pillow lavas; $3A_{1d}$, tuffaceous siltstone.
$3A_2$	Feeder Granodiorite: whitish-brown, medium grained biotite granodiorite, with coarse grained quartz phenocrysts.

SYMBOLS

Geological boundary (defined, assumed)

Outcrop boundary (examined)

Elevations in feet above mean sea level

Approximate magnetic declination: 28° W

Formation numbers taken from and geology modified from "Geological Map of Buchans Area, Newfoundland," by Thurlow and Swanson, 1982.

Figure 44.1. Geological map of upper Wiley's River area, Buchans, Newfoundland.

The Feeder Granodiorite is a whitish brown rock, which becomes increasingly reddish toward the contact with the Topsails granite in Wiley's River area. The granodiorite is medium grained with abundant coarse grained quartz phenocrysts. Quartz crystals are generally rounded (5-10 mm average diameter), clear, locally appear as aggregates of crystals rather than true individual phenocrysts, and comprise 25-30 per cent of the rock by volume. The predominant feldspar is plagioclase, comprising 55-65 per cent of the rock, that is subhedral (locally euhedral), white and frequently darkened red-brown (by hematite). Fine grained clots of subhedral biotite crystals constitute 5 per cent. A fine grained pink-brown mineral (potash feldspar?) occurs interstitially to the quartz phenocrysts and the plagioclase (plus biotite) masses, and comprises 5 per cent of the rock.

The Topsails granite in this area is brick-red, ranges from fine- to medium-grained and is consistently equigranular. All feldspars are medium to dark red and comprise 65 per cent of the rock. Quartz crystals are clear, 1-3 mm across and form 30 per cent of the rock and biotite 5 per cent. The granite is miarolitic, especially near the contact with Feeder Granodiorite. The cavities are typically 1 mm in diameter, although near the contact they are 3-5 mm and partly filled with variable amounts of quartz,

Table 44.1

Field Classification of Granitoid Clasts

Clast type	Dominant colour, groundmass	Grain size	Phenocryst type	Mafic mineral content	Distinguishing features
1	strong-moderate brown-red	f.-m.g.	qtz. (c.g.)	variable; f.-m.g., generally distinct	colour strong brown-red; f.-m. grain size; presence of qtz. phenocrysts
2	strong-moderate brown-red	f.g.	equigranular	f.-m.g., distinct, variable	colour, strong-mod. brown-red; f. grain size; absence of qtz. phenocrysts
3	black & white with light browns, occasionally greenish or greyish	m.-c.g.	rare qtz. (c.g.)	m.-c.g.; distinct and indistinct in different clasts	coarse grain size; equigranular; spotted colour (black and white)
4	moderate-light brown (weak red)	m.g., rarely f.g.	qtz. (c.g.); rock may be m.g. & equi-granular	variable; distinct & indistinct	qtz. phenocrysts; lighter red colour than type 1, otherwise the same, includes medium grained equigranular equivalents
5	light brown-pink darkened with mafic minerals in some	f.-m.g.	equigranular	generally distinct except when very abundant & f.g.	absence of qtz. phenocrysts; same colour as type 4, or even less pink (or red)
6	variable, light green with white & light brown	f.-m.g.	qtz. (m.-c.g.) rare m.g. plag.	generally indistinct variable	presence of qtz. phenocrysts; large amount of qtz. present; absence of brown & especially red colours except in isolated crystals
7	grey-white, rarely very light brown	f.g. (rarely m.g.)	equigranular	typically indis-tinct, content varies from 0-20%	white and/or grey colour; commonly with pyrite
8	greenish-yellow with occasional red tinges	f.-m.g.	qtz. (m.g.)	indistinct	vague crystal boundaries, with the exception of qtz. phenocrysts; most likely a volcanic rock
9	dark-moderate greenish with specks of white (plag.), red (K-feldspar) and qtz.	f.g.	equigranular; rare m.g.	abundant, distinct, prob-ably amphibole	dark, spotted appearance; fine grained; seen only in siltstone breccia
10	dark green with grey & light brown	f.g.	K-feldspar & plag. (m.g.) rare qtz. (smaller)	abundant (to 40%) distinct	similar to type 9 but with abundant plag. phenocrysts – only one sample seen
11	strong brown-red with white	f.-m.g.	qtz. (m.g.)	few to 5%, distinct	very abundant qtz; brown-red colour
12	variable; a mixture of whites, greens and weak browns	m.-c.g.	equigranular	unaltered, 10-15%	large grain size; equigranular; greenish plag. crystals (?)

Table 44.2

Classification – MacLean Extension Orebody
(modified after E.A. Swanson, personal communication, 1982)

Ore Horizon Sequence in MacLean Extension area	Upper Baritic Ore-Bearing member (without granitoid clasts)	Baritic unit
		Tuffaceous or breccia unit
		Baritic unit
	Felsic Pyroclastic member	Strongly lithic beds with isolated sulphide clasts; occasional polylithic breccia bed with minor granitoid clasts
	Lower Ore-Bearing member (Generally gradational from high grade at bottom to low grade arenaceous granitoid-bearing breccia-conglomerate. The top baritic bed seems distinct).	Baritic low grade polylithic ore breccia
		Granitoid-bearing breccia-conglomerate with arenaceous matrix. Beds of arenaceous wacke within unit
		Granitoid-bearing ore breccia-conglomerate; low grade with some arenaceous matrix
		Polylithic ore breccia; matrix becomes increasingly arenaceous towards top
		Mainly massive sulphide, in part streaky with minor lithic material
Intermediate Footwall Formation		Interbedded and altered mafic to felsic flows, pyroclastic rocks and volcanic breccias, related tuffaceous pyritic siltstone and wacke

specular hematite, fluorite and a silvery grey unidentified mica. At the contact, the granite shows a weakly developed graphic texture.

Summary

Granitoid clasts within the Buchans Group breccia-conglomerate beds and pyroclastic units comprise several lithologic types. Those clasts with coarse grained quartz phenocrysts (to 1 cm) in a brown-red groundmass are megascopically similar to the Feeder Granodiorite in the Wiley's River area.

The relationship of the Feeder Granodiorite to the Buchans Group remains unknown. Topsails granite has a chilled margin against the Feeder Granodiorite. Brick-red granitic dykes of presumed Topsails affiliation cut the Feeder Granodiorite. Both intrusive bodies are cut by diabasic dykes.

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