ITEM 1

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R.V. KIRKHAM

3.2 Rock Types

Rock types at Yorke-Hardy have been described in various company reports and by Bright and Jonson (1976). Lithologic units are Jurassic Hazelton Group and Cretaceous Skeena Group. Intrusive rocks are as follows from oldest to youngest: granodiorite sheet, lamprophyre dykes and sills, rhyolite plug, Hudson Bay Mountain Stock (previously called the quartz monzonite stock) and quartz-felspar porphyry dykes (Figure 3.2).

3.2.1 Volcanic and Sedimentary Rocks

Hazelton Group

Hazelton Group comprises a thick continuous sequence of Early to Late Jurassic, poorly layered, metamorphosed volcanic and sedimentary rocks. On Hudson Bay Mountain, volcanic rocks include fragmentals and flows of intermediate composition (Appendix 2) and sedimentary rocks include limestones, mudstones, cherts, and conglomerates. Fossil fauna indicate a lower Middle Jurassic age (Jones 1926). Mapping and core logging have shown volcanic horizons are lenticular, rarely contain marker beds and have been hornfelsed, domed, fractured, faulted, and bleached making correlation difficult (Allen 1962). In the adit, dark brown pyroclastics and lesser amounts of flows are exposed and dip moderately to steeply northeast. The Hazelton Group has been divided into:

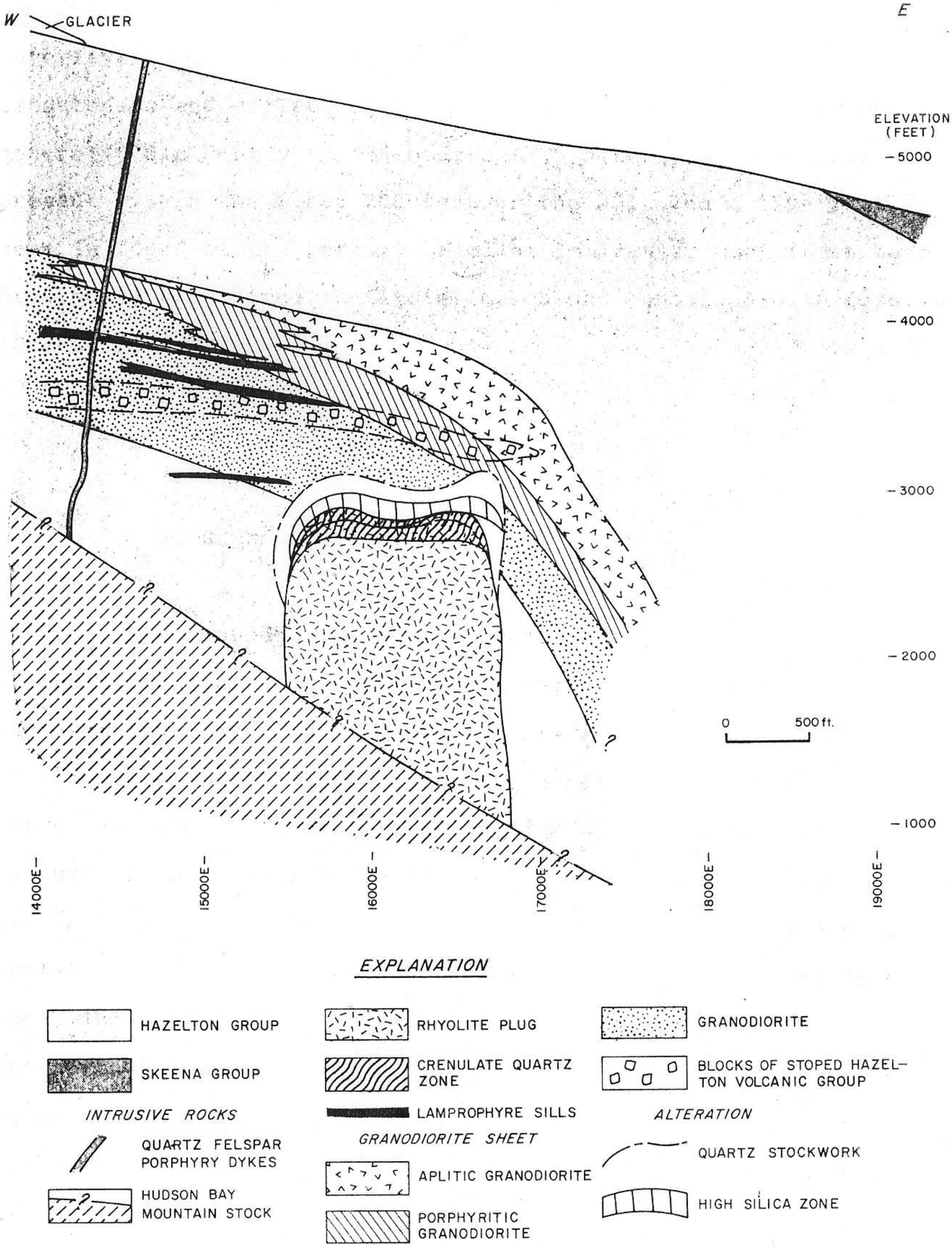


FIGURE 3.2. YORKE-HARDY GENERALIZED GEOLOGICAL CROSS SECTION (SOUTH OF ADIT)

(a) Basaltic to andesitic agglomerates (including tuff, crystal tuff, lithic tuff, lapilli tuff, and breccia) and flows (massive to porphyritic).

(b) Porcellaneous rocks, which are characterised by intense silicification and bleaching, producing a hard light grey rock with 2 mm felspar phenocrysts in an aphanitic groundmass. (These closely resemble other locally intensely altered volcanic rocks rendering them of little use as marker beds.)

(c) Quartz-eye unit, which is a medium to dark grey crystal lithic lapilli tuff with up to 20% euhedral quartz and felspar crystals in an aphanitic groundmass. (It is the most useful marker bed within the volcanic sequence.)

(d) Various hypabyssal mafic to felsic intrusions.

(e) A flow banded, porphyritic, locally spherulitic rhyolite, 800 feet thick, with a 6000 foot strike length which crops out on the north side of Glacier Gulch.

Skeena Group

Lower Cretaceous Skeena Group cropping out on the northeast side of Hudson Bay Mountain is found in both unconformable and fault contact with Hazelton volcanic rocks. In the first 1320 feet of the adit dark coloured, well bedded, interlayered greywackes, pebble conglomerates, argillites, sandstones, and siltstones of the Skeena Group are exposed and generally dip gently to 45° northeast. Minor coal seams are present within the first 200 feet of the adit and a five foot seam is found at the portal. Similar lenticular coal seams have previously been mined in Glacier Gulch and contain Albian fossils (Carter 1974).

3.2.2 Intrusive Rocks

Granodiorite Sheet

The granodiorite sheet intrudes Jurassic Hazelton volcanic rocks and is intruded by a Late Cretaceous to Early Tertiary rhyolite plug thus placing its age at Upper Jurassic or Cretaceous. Jonson (1966) notes the sheet exhibits both concordant and discordant relationships with the rocks it intrudes. The granodiorite does not crop out but has been partially defined by drilling and exposures underground over a strike length of almost 4,000 feet and along dip for over 4500 feet. The granodiorite thickens from approximately 250 feet at its northwest known limit to a maximum of 1,800 feet and thins again to 1000 feet at its southeast known limit. The sheet is wedge shaped with a regular base that dips 20° to the southeast to approximately 16000E where it steepens to 70° (Figure 3.2).

Within the sheet, three main divisions are recognized:

A. Aplitic granodiorite

B. Porphyritic granodiorite

C. Granodiorite

These divisions are interpreted as products of insitu igneous differentiation (Jonson, et. al, 1968) and display a general increase of ferromagnesium minerals toward the base of the sheet. Not surprisingly in this type of mineral deposit, textures and contacts are masked by alteration. Early discussions by various authors including Jonson (1966) suggested a possible metasomatic origin for the sheet.

The divisions are based on the following megascopic criteria:

1. Grain size and texture
2. Composition
3. Colour, chiefly dependent upon mafic content and therefore strongly influenced by alteration.

The divisions are further explained as follows:

A. Aplitic granodiorite forms the upper northeast edge of the sheet and dips northeasterly attaining a maximum thickness of 800 feet (Figure 3.2). The aplitic granodiorite is white to light grey, greenish grey, tan, and buff. No primary mafic minerals or their sites have been identified. Although grain size varies, it is typically an even 0.5 mm grained rock with saccharoidal texture. Within the aplitic granodiorite, local areas are characterised by spectacular granophyric intergrowth of quartz, plagioclase and minor K-felspar. Jonson et al. (1968) suggests that some of the quartz observed in thin section may result from exsolution. The aplitic granodiorite may contain phenocrysts of subhedral felspar and quartz to 2 mm. Modal analyses (Appendix 1, Table 3.1, Figure 3.3) indicate an average rock is composed of 35 percent quartz, 18 percent K-felspar and 47 percent plagioclase. Plagioclase composition (Card 1972, Steininger 1975) ranges from An_{10} to An_{18}.

B. Porphyritic granodiorite forms the northeastern upper and central portion of the sheet attaining a maximum thickness of 800 feet (Figure 3.2). Locally porphyritic granodiorite has been observed in intrusive contact with granodiorite and aplitic granodiorite. Porphyritic granodiorite is light coloured, usually grey to greenish grey. Clots and shreds of chlorite, pyrite and magnetite probably occupy original mafic mineral sites. The groundmass is characteristically aphanitic and rarely fine-grained with granitic texture. Phenocrysts are plagioclase and quartz. Plagioclase phenocrysts are buff to greenish grey, 1 to 5 mm across, euhedral to ragged and comprise 10 to 30 percent of the rock. Quartz phenocrysts are typically euhedral and range in size from 0.75 to 2.5 mm, and form 1 to 10 percent of the rock.

Modal analyses (Appendix 1, Table 3.1, Figure 3.3) indicate a variable K-felspar-plagioclase ratio which is attributed to secondary development of K-felspar. K-felspar content averages 13 percent, quartz 36 percent, plagioclase 49 percent, and mafic minerals 2 percent. Plagioclase determinations (Steininger 1975) range from An_{28} to An_{33}.

C. Granodiorite is the most commonly identified rock type in the sheet, forming the entire southern limit and lower portions of the sheet with a maximum thickness of 1400 feet. Granodiorite is mottled medium to dark green and grey, but may be pink or brown. The original mafic content was probably 5 to 10 percent. Variable amounts of chlorite, magnetite, epidote, secondary biotite, pyrite, and calcite occur as aggregates, wisps, shreds, and clots and probably occupy some orthomagmatic felspar and mafic mineral sites. Grain size ranges from 0.5 to 1.5 mm, and grains are subhedral to andhedral. The granitic texture is commonly diffuse due to alteration. Many quartz felspar crystals show granophyric and micrographic intergrowth. Locally subhedral quartz and felspar phenocrysts to 5 mm form up to 5 percent of the rock. Modal analyses (Appendix 1, Table 3.1, Figure 3.3) indicate granodiorite consists of 54 percent plagioclase, 9 percent K-felspar, 33 percent quartz, 4 percent mafic minerals. Plagioclase compositions (Steininger 1975) are An_{32} to An_{34}.

Table 3.1 - Yorke-Hardy Granodiorite Sheet

Name	A Aplitic Granodiorite	B Porphyritic Granodiorite	C Granodiorite
Maximum Thickness	800 feet	800 feet	1400 feet
Texture	Saccharoidal, rarely granophyric	Porphyritic	Granitic
Grain Size	0.5 mm	Groundmass is aphanitic phenocrysts 1-5 mm	1 mm
Phenocrysts	Rare quartz and plagioclase to 2mm	Ragged plagioclase 1-5 mm, 10-30%, quartz 0.75-2.5 mm, 1-10%	Quartz 2-5 mm, 1-3%, K-felspar 2-5 mm, 1-3% plagioclase 2-5 mm, 1-3%
	Average Modes (percent)		
Quartz	35	36	33
K-felspar	18	13	9
Plagioclase	47 An_{10}-An_{18}	49 An_{28}-An_{33}	54 An_{32}-An_{34}
Mafics	0	2	4
	Average of 4 point counts	Average of 10 point counts	Average of 7 point counts

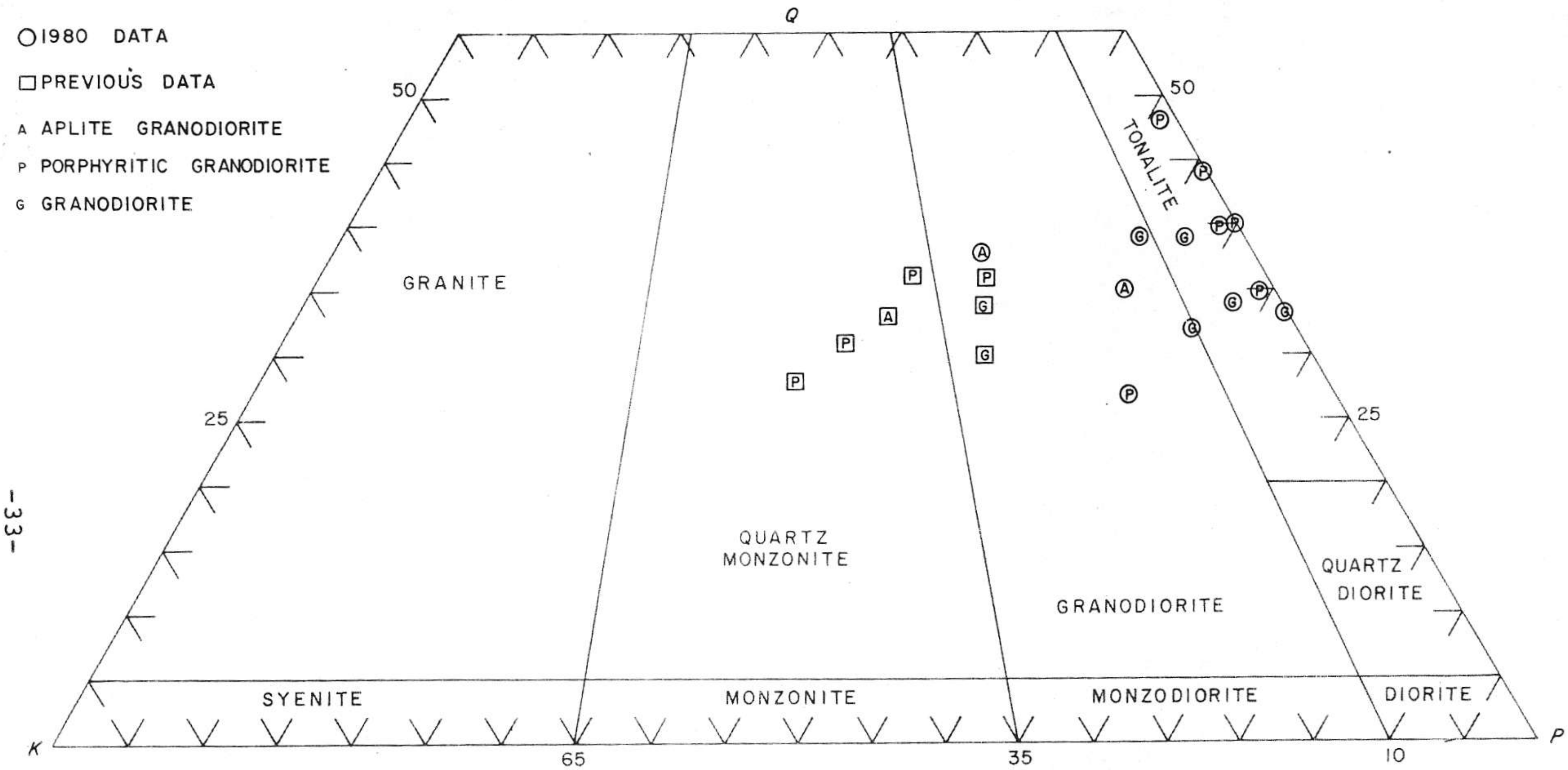


FIGURE 3.3. YORKE-HARDY GRANODIORITE SHEET TERNARY MODAL PLOT FOR QUARTZ-K-FELSPAR-PLAGIOCLASE (CLASSIFICATION MODIFIED AFTER HUTCHISON, 1970.)

Within the sheet are numerous dark green to black stoped Hazelton volcanic blocks forming zones to 100 feet thick which are easily traced between drill holes. Blocks are usually equidimensional up to 10 feet thick (Jonson 1966). Blocks consist of 60 percent plagioclase (An_{28} to An_{38}), 38 percent mafic minerals (chiefly chlorite after hornblende), magnetite pyrite and up to 2 percent quartz. Some stoped volcanic blocks within the granodiorite are observed to be partially digested and locally increase the mafic content of the sheet.

The sheet is locally brecciated. Breccia zones commonly contain subrounded fragments (indicative of extensive transport) of granodiorite in a mafic matrix. Breccias occur as dykes and local zones that can be traced underground over short distances.

Lamprophyre Dykes and Sills

Numerous lamprophyre dykes and sills cross cut Hazelton volcanic rocks and the granodiorite sheet. The dykes and sills vary from narrow irregular lenses to 50 foot thick bodies and are green, black or brown with a diabasic or equigranular texture. Lamprophyres consist of 40 percent plagioclase and 60 percent chlorite and hornblende with minor magnetite, and pyrite (Jonson 1966).

Rhyolite Plug

Twelve diamond drill holes have intersected a rhyolite plug (Figure 3.4, Table 3.2) which intrudes Hazelton volcanic rocks and the base of the granodiorite sheet. To date, 5,322 feet of rhyolite plug plus 465 feet of its brecciated contact (DDH 113) has been cored. Maximum penetration of the rhyolite plug is by DDH 72 which cored 1381 feet through the plug to the intrusive contact of the Hudson Bay Mountain stock. The rhyolite plug is oval in plan with steep walls and a relatively flat top near 3000 feet elevation. Astride the contact with country rocks is a zone of quartz stockworks that extend into the Hazelton volcanic rocks and granodiorite sheet for 300 feet and into upper portions of the plug for 200 feet. (Table 3.2, Figure 3.4). To date, a total of 4,252 feet of stockworks have been intersected. Coalescing of quartz stockworks produced a high silica zone averaging 130 feet thick which contains only isolated relics of rhyolite plug and country rocks and masks the intrusive contact. Both stockwork and high silica quartz are associated with trace magnetite, fluorite, biotite and topaz. Contoured structural plots of available data define the outline of quartz stockwork (Figure 3.5), high silica zone (Figure 3.6) and rhyolite plug (Figure 3.7). The former two mimic the shape of the top of the rhyolite plug which is interpreted as their parent (Figure 3.8).

July 15/85 drill logs in hand or
" " to be requested

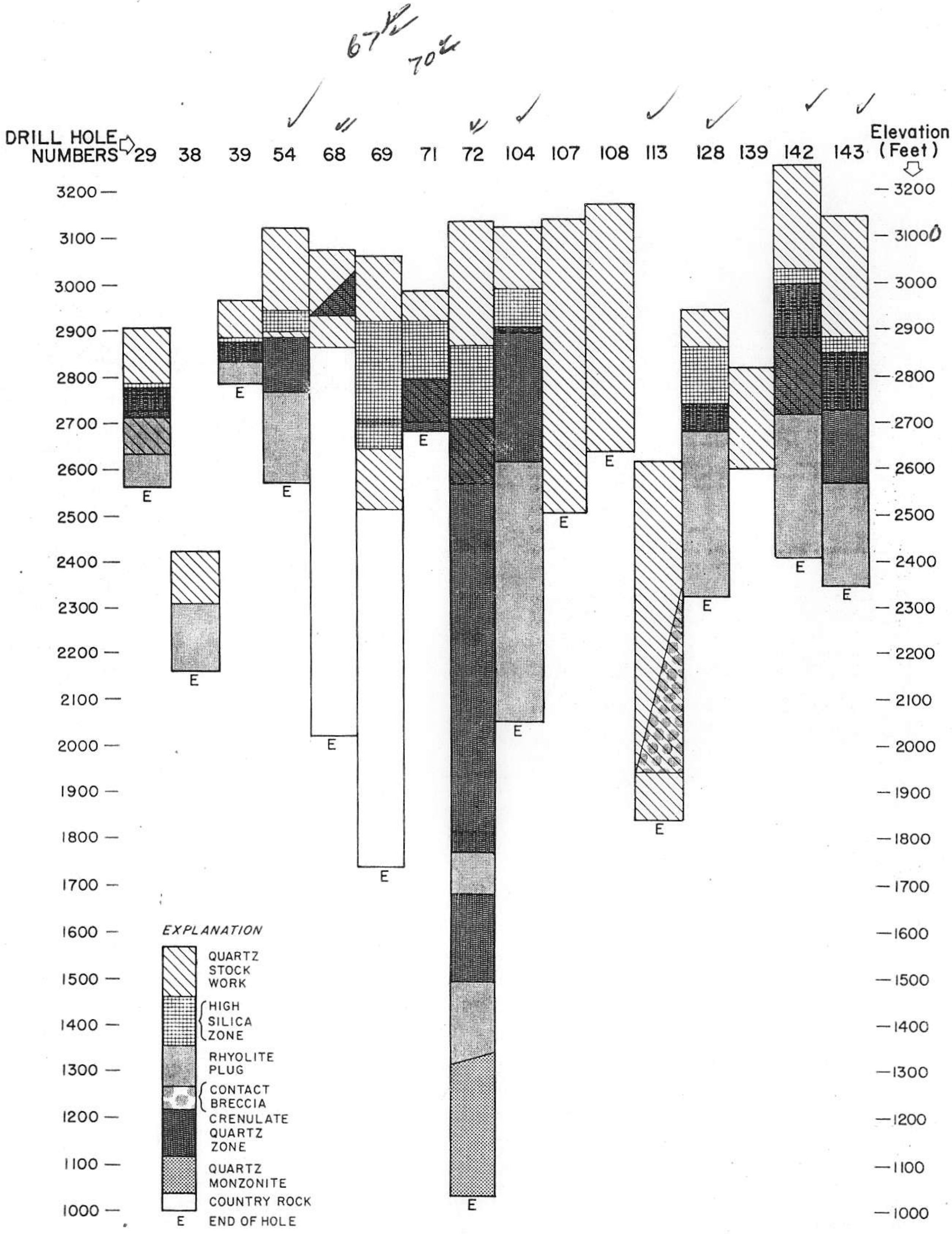


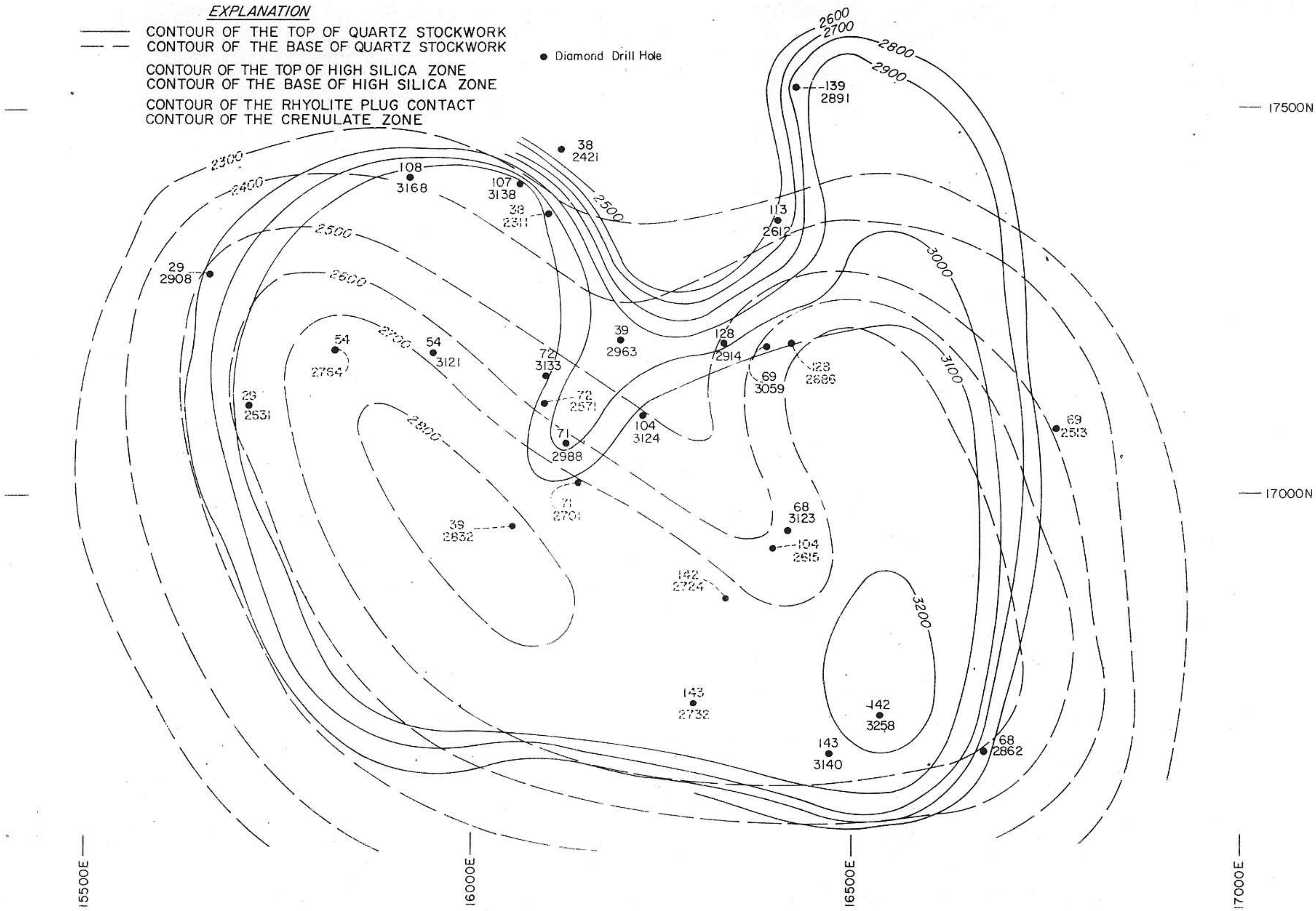
FIGURE 3.4. YORKE-HARDY RHYOLITE PLUG DRILL HOLE INTERSECTIONS.

TABLE 3.2 - YORKE-HARDY RHYOLITE PLUG DRILL HOLE INTERSECTIONS

DDH	DATE DRILLED	COLLAR LOCATION	BASE LOCATION	TOTAL FOOTAGE	LOCATION OF INTERSECTION OF QUARTZ STOCKWORK (if pres.)	TOTAL FOOTAGE OF QUARTZ STOCKWORK	LOCATION OF INTERSECTION OF HIGH SILICA ZONE (if pres.)	TOTAL FOOTAGE IN HIGH SILICA ZONE	DESCRIPTION OF COUNTRY ROCK, DYKES, QUARTZ STOCKWORK, & HIGH SILICA ZONE	LOCATION OF INTERSECTION OF RHYOLITE PLUG	TOTAL FOOTAGE IN RHYOLITE PLUG	DESCRIPTION OF RHYOLITE PLUG
29	1963, extend. 1964	15135E 18230N 5370 ft.	15731E 17069N 2563 ft.	3116	15664E 17290N 2908 ft. 15716E 17119N 2631 ft.	275 (2700-3030)	15686E 17217N 2780 ft. 15695E 17188N 2735 ft.	55 (2849-2904)	7, 2" to 2 ft. pink porphyry dykes (1% 1mm quartz and felspar phenocrysts in aphanitic groundmass) & numerous barren quartz veins cut black, locally bleached magnetite rich tuff. Quartz veins coalesce to form high silica zone.	15688E 17211N 2770 ft.	255 (2861-base)	2861-2904 10% relicts of possible chill zone with scarce quartz phenocrysts and characterized by crenulate quartz bands; between dense quartz veining (high silica zone). 2904-2920 Quartz rhyolite porphyry (as above). 2920-3031 Alternating greenish buff and salmon pink quartz porphyry containing 5% 1 mm euhedral quartz phenocrysts and sparce 1 mm felspars in an aphanitic groundmass. Local crenulate quartz bands. 3031-3116 (End of hole) Pink quartz porphyry with larger quartz phenocrysts. Veins are quartz, quartz + molybdenite, quartz, + pyrite and quartz + topaz.
38	1965	15810E 18578N 5062 ft.	16074E 17241N 2162 ft.	3255	16120E 17448N 2421 ft. 16104E 17362N 2311 ft.	140.5 (2920-3060.5)	N.I.	N.A.	20, 1/8" to 10 ft. dykes (as above) and barren quartz veins cut black, locally bleached magnetite rich tuff.	16104E 17362N 2311 ft.	194.5 (3060.5-base)	3060.5-3080 Chill zone, 2% quartz and felspar phenocrysts in an aphanitic to very fine grained groundmass. Cross cutting pink aplite dykes and volcanic inclusions. 3080-3255 (End of hole) Pink to buff colored, contains 3% 1-3 mm round, equant quartz eyes, 1-2% 1-2 mm vague felspar crystals and 1% 1-2 mm biotite flakes, now replaced by chlorite in an aphanitic to aplitic groundmass. Various inclusions (chill zone, crenulate quartz banded rhyolite porphyry and volcanics) and dykes (pink aphantitc to aplitic texture). Orthomagmatic plagioclase determinations at 3104 ft An_2, and at 3038 An_{3-5}.
39	1965	16578E 18931N 4736 ft.	15999E 16867N 2784 ft.	2981	16198E 17201N 2968 ft. 16058E 16960N 2832 ft.	244 (2540-2860)	16110E 17047N 2879 ft. 16075E 16987N 2847 ft.	76 (2749-2825)	15, 2" to 19 ft. dykes (as above) and barren quartz veins cut breccia of quartz veined tuff and granodiorite fragments in matrix of quartz and biotite with rare fluorite. High silica zone as fragments in breccia with some rhyolite prophyry fragments. Matrix is quartz.	16102E 17032E 2871 ft.	214 (2767-base)	2767-2782 Brecciated, fragments are high silica and rhyolite characterized by crenulate quartz bands. 2782-2825 Relicts of chill zone of plug, aphanitic, non-porphyritic, characterized by crenulate quartz bands in high silica zone. 2825-2839 Rock type as above cut by quartz stockwork. 2839-2848 Quartz rhyolite porphyry characterized by crenulate quartz bands and cut by quartz stockwork. 2848-2859 Grey green rhyolite porphyry, 3% 2-4 mm round, euhedral quartz eyes and 10% 2-4 mm equant felspar crystals in an aphanitic groundmass. 2859-2909 As 2839-2848 2909-2981 (End of hole) as 2848-2859
54	1966	16095E 17200N 3506 ft.	15773E 17196N 2572 ft.	989	15953E 17189N 3121 ft. 15829E 17188N 2764 ft.	317.5 (409-788)	15889E 17185N 2944 ft. 15868E 17184N 2887 ft.	61.5 (599-660.5)	1, 1 ft. dyke and numerous barren quartz veins cut grey green to grey brown granodiorite which is locally quartz flooded. Quartz veins coalesce to form high silica zone.	15868E 17181N 2887 ft.	328.5 (660.5-base)	660.5-788 Buff colored, round quartz eyes and sparce subhedral felspar in a very fine grainec groundmass, cut by quartz stockwork to 788 ft. 788-989 (End of hole) Buff to pink colored, euhedral quartz and felspar phenocrysts to 3 mm become progressively more abundant in fine grained groundmass.
68	1967	16112E 17189N 3506 ft.	17172E 15844N 2573 ft.	2025	16456E 16913N 3073 ft. 16672E 16668N 2862 ft.	390 (620-1010)	N.I.	N.A.	Intense quartz stockwork cuts granodiorite commonly replaced by silica and having a cloudy texture.	16500E 16870N 3028 ft. 16591E 16770N 2934 ft.	165 696-861	696-702 Contact obscurred by intense quartz stockwork and silica replacements. Relicts of aphanitic rock containing rare pin points of quartz and small crenulate quartz bands, interpreted as chill zone. 702-728 Intense quartz stockwork and silica replacements surround relicts of aphanitic rhyolite chill zone. 728-789 Intense quartz stockwork and silica replacements surround relicts of aphanitic to fine grained rhyolite characterized by crenulate quartz bands. 789-810 Intense quartz stockwork and silica replacements surround relicts of aphanitic rhyolite with a few anhedral quartz pinpoints and ghost felspars to 2 mm. 810-842 (End of hole) Intense quartz stockwork and silica replacements surround relicts of aphanitic to fine grained rhyolite with graphic texture, 2-3 mm quartz phenocrysts and crenulate quartz bands.
69	1968	16108E 17197N 3507 ft.	17296E 16677N 1743 ft.	2226	16390E 17192N 3059 ft. 16762E 17084N 2513 ft.	330 (530-1200)	16485E 17178N 2918 ft. 16672E 17122N 2642 ft.	340 (700-1040)	13 ft. dyke of salmon pink porphyritic rhyolite with aphanitic groundmass. Phenocrysts are 2 mm quartz and felspar. Dyke, aplitic granodiorite and lamprophyre cut by intense quartz stockwork. Coalescing of quartz veins results in high silica rock. (Dyke: 16630E 17139N 2706 ft. - 16635E 17135N 2696 ft.)	N.I.	N.A.	N.A.
71	1968	16109E 17192N 3507 ft.	16140E 17006N 2682 ft.	838	16128E 17070N 2988 ft. 16139E 17010N 2701 ft.	104 (533-827)	16130E 17056N 2923 ft. 16137E 17017N 2737 ft.	190 (600-790)	Porphyritic and aplitic granodiorite cut by quartz veins forming stockwork with rare green & purple fluorite and locally replaced by silica, with up to 10% disseminated pyrite. Quartz veins coalesce to form high silica zone cut by magnetite veins.	16135E 17030N 2795 ft. obscurred by high silica	107 (731-base)	731-784 Relicts have quartz eyes in high silica rock. 784-838 (End of hole) Buff, greenish or white porphyry with 2-3 mm quartz eyes in an aphanitic groundmass, characterized by crenulate quartz bands and cut by quartz stockwork to 827 ft.
72	1968	16108E 17194N 3507 ft.	16159E 17121N 1037 ft.	2476	16098E 17156N 3133 ft. 16098E 17116N 2571 ft.	407 (376-940)	16095E 17134N 2867 ft. 16096E 17123N 2710 ft.	157 (643-800)	3, 1-27 ft. dykes cut breccia of granodiorite, volcanic, aplite, & quartz veins. Dykes are unbrecciated, post quartz stockworks, & porphyritic, containing quartz eyes & pyrite crystals less than 0.5 mm in an aphanitic to fine grained groundmass (logged as microporphyries). Barren quartz stockwork veins common, are brecciated as are quartz-molybdenite veins. Coalescing of veins results in high silica rock which is cut by numerous magnetite veins.	16096E 17123N 2710 ft. 16142E 17111N 1331 ft.	1381 (800-2181)	800-941 Brecciated quartz porphyry, quartz stockworks also brecciated, cross cutting banded Type I veins and 'microporphries' at 88-892 and 935-941. 941-1347 Breccia, fragments are buff to greenish white with quartz eyes to 4 mm, characterized by crenulate quartz bands and cut by quartz stockworks. 'Microporphyries' 1060-1115 and 1168-1175. 1347-1580 Brecciated salmon pink quartz porphyry cut by 3, 15 cm to 2 meter pink intramineral dykes. 1580-1836 Salmon pink quartz porphyry. 1836-2016 Brecciated salmon pink quartz porphyry characterized by crenulate quartz bands and cross cut by 2, 10 cm to 6 meter quartz monzonite dykes. 2016-2181 Salmon pink quartz porphyry. 2181 Intrusive contact with younger quartz monzonite stock.

TABLE 3.2 - YORKE-HARDY RHYOLITE PLUG DRILL HOLE INTERSECTIONS CONTINUED

DDH	DATE DRILLED	COLLAR LOCATION	BASE LOCATION	TOTAL FOOTAGE	LOCATION OF INTERSECTION OF QUARTZ STOCKWORK (if pres.)	TOTAL FOOTAGE OF QUARTZ STOCKWORK	LOCATION OF INTERSECTION OF HIGH SILICA ZONE (if pres.)	TOTAL FOOTAGE IN HIGH SILICA ZONE	DESCRIPTION OF COUNTRY ROCK, DYKES, QUARTZ STOCKWORK, & HIGH SILICA ZONE	LOCATION OF INTERSECTION OF RHYOLITE PLUG	TOTAL FOOTAGE IN RHYOLITE PLUG	DESCRIPTION OF RHYOLITE PLUG	
104	1971	16109E 17192N 3508 ft.	16619E 16581N 2054 ft.	1675	16230E 17104N 3124 ft. 16394E 16928N 2615 ft.	465 (412-976)	16275E 17064N 2986 ft. 16304E 17035N 2896 ft.	99 (563-662)	Granodiorite is cut by barren quartz stockwork & local high silica zones. 1, dyke, 602-627, microporphyry, siliceous with disseminated pyrite & magnetite cross cuts stockwork. Quartz veins coalesce to form high silica zone with numerous magnetite veins.	16301E 17039N 2907 ft.	1025 (650-base)	650-662 662-976 976-1107 1107-1136 1126-1185 1185-1675	High silica with 5% relicts of rhyolite characterized by crenulate quartz bands and minor quartz phenocrysts. Quartz porphyry characterized by crenulate quartz bands cross cut by intense quartz stockwork. Rhyolite with 3-4 mm quartz phenocrysts, local crenulate bands. Quartz porphyry characterized by crenulate quartz bands. as 976-1107 (End of hole) Variably altered grey-green with 3-4 mm quartz phenocrysts in a very fine grained groundmass. Cross cut by quartz monzonite dyke at 1210-1215.
107	1971	16100E 17401N 3506 ft.	16075E 17403N 2502 ft.	1007	16066E 17401N 3138 ft.	637 (370-base)	N.I.	N.A.	Black, aphanitic magnetite & pyrrhotite rich tuffs & granodiorite, characterized by biotite-sulphide alteration, are cut by barren quartz stockworks. 50% quartz veins 780-820 (16072E 17405N 2728 ft. 16073E, 17406N 2688 ft), approaches high silica zone. Numbers & size decrease from 900 ft. to base.	N.I.	N.A.		N.A.
108	1971	16096E 17401N 3506 ft.	15613E 17543N 2634 ft.	1012	15922E 17413N 3168 ft.	632 (380-base)	N.I.	N.A.	Black, aphanitic, magnetite rich tuffs & granodiorite are cut by barren quartz stockworks, numbers & size decrease from 880 to base.	N.I.	N.A.		N.A.
113	1971	16104E 17398N 3506 ft.	16680E 17298N 1840 ft.	1766	16405E 17354N 2612 ft.	821 (945-base)	N.I.	N.A.	Country rocks are cut by quartz stockwork & quartz-molybdenite veins then brecciated. Fragments are granodiorite & volcanic rocks. Breccia is cross cut by quartz-molybdenite veins & 12, 1-10 ft. greenish grey to pinkish buff aphanitic dykes containing 1 mm quartz & felspar phenocrysts & stoped fragments of quartz vein, both barren & with molybdenite, granodiorite, volcanic rock & from 940 down rare quartz porphyry. Below breccia containing quartz porphyry fragments, 10 quartz porphyry dykes 1/2"-2" wide cross cut black crystal tuffs.	? 16483E 17338N 2380 ft. 16641E 17305N 1944 ft.	? 465 (1190-1655)	1190-1278 1278-1290 1290-1305 1305-1655	10% quartz porphyry fragments in breccia, becoming steadily more abundant. 100% large fragments of crenulate and non-crenulate quartz porphyry. Mixed breccia of large quartz porphyry fragments with minor granodiorite fragments. Breccia, variable fragment composition and percentage includes quartz prophyry, granodiorite and volc n c rocks. Quartz porphyry fragments are dominant 1392-1424, 1546, 1580, 1627.5-1655. Breccia is cross cut by dykes, 2-18 feet wide.
128	1971	16113E 17196N 3507 ft.	16557E 17176N 2321 ft.	1267	16333E 17198N 2914 ft. 16352E 17197N 2863 ft.	55 (632-687)	16352E 17197N 2863 ft. 16420E 17190N 2686 ft.	190 (687-877)	Granodiorite is brecciated and cross cut by 2 dykes, 2 ft. & 7 ft. wide, with few quartz phenocrysts in a greenish buff aphanitic matrix. Below this, granodiorite is cut by a further 2 dykes, 4.5 ft & 48.5 ft characterized by brown biotite-sulphide alteration & cross cut by a barren quartz stockwork. Quartz veins coalesce to form a high silica zone containing relicts of granodiorite and volcanic rocks and minor quartz porphyry with crenulate bands from 781 onward.	16399E 17192N 2741 ft.	449 (818-base)	818-852 852-877 877-1267	20% relicts of quartz porphyry characterized by crenulate quartz bands, 5% quartz porphyry and occasional volcanic rock in high silica zone. Relicts of quartz porphyry and quartz porphyry characterized by crenulate quartz bands in high silica rock. (End of hole) Large euhedral quartz phenocrysts and felspar phenocrysts in an aphanitic to fine grained groundmass.
139	1971	16103E 17600N 3506 ft.	16600E 17465N 2595 ft.	1050	16428E 17535N 2891 ft.	350 (700-base)	N.I.	N.A.	Granodiorite & bleached green-grey aphanitic tuffs are cut by barren quartz stockworks.	N.I.	N.A.		N.A.
142	1972	16640E 16659N 3511 ft.	16253E 16979N 2405 ft.	1217	16535E 16714N 3258 ft. 16348E 16865N 2724 ft.	419 (280-865)	16449E 16774N 3029 ft. 16397E 16818N 2877 ft.	166 (532-698)	Granodiorite is cut by 1, 2.5 ft. dyke, cream to buff colored with felspar phenocrysts in an aphanitic groundmass. Both granodiorite & dyke are cut by barren quartz stockworks that coalesce to form a high silica zone containing granodiorite and lamprophyre relicts.	16437E 16783N 2995 ft.	649 (568-base)	568-698 698-865 865-887 887-933 933-1040 1040-1070 1070-1120 1120-1217	10% relicts of quartz porphyry, some characterized by crenulate quartz bands in high silica zone. Creamy buff rhyolite has few euhedral quartz phenocrysts in a fine grained groundmass, characterized by crenulate quartz bands and cut by barren quartz stockwork. Grey-white siliceous quartz porphyry characterized by crenulate quartz bands. Green-brown siliceous quartz porphyry characterized by biotite-sulphide alteration, contains local crenulate bands. Grey-brown-buff quartz porphyry with biotite-sulphide alteration. Light grey to white, numerous euhedral quartz phenocrysts in a sugary groundmass. As 1040-1070 and characterized by crenulate quartz bands. (End of hole) As 1040-1070.
143	1972	16639E 16655N 3511 ft.	16149E 16828N 2342 ft.	1284	16467E 16670N 3140 ft. 16353E 16704N 2881 ft.	283.5 (410-693.5)	16353E 16704N 2881 ft. 16293E 16731N 2732 ft.	163.5 (693.5-857)	Granodiorite is cut by barren quartz stockwork & 1 aphanitic felsic dyke, characterized by brown biotite & sulphide alteration. Coalescing of quartz veins results in high silice rock with rare relicts of granodiorite.	16340E 16710N 2849 ft.	554 (730-base)	730-857 857-914 914-922 922-930 930-971 971-1040 1040-1284	10% relicts of quartz porphyry characterized by crenulate quartz bands in high silica zone. Green quartz porphyry characterized by crenulate quartz bands and brown biotite + sulphide alteration. 10% relicts as 857-914 in high silica zone. Green quartz porphyry characterized by crenulate quartz bands and brown biotite + sulphide alteration. Quartz porphyry with only local crenulate banding. As 922-930. (End of hole) Buff to greenish buff quartz porphyry with only local crenulate banding.



FIGURES 3.5, 3.6 AND 3.7. YORKE-HARDY STRUCTURAL CONTOUR PLAN FOR QUARTZ STOCKWORK, HIGH SILICA ZONE AND RHYOLITE PLUG

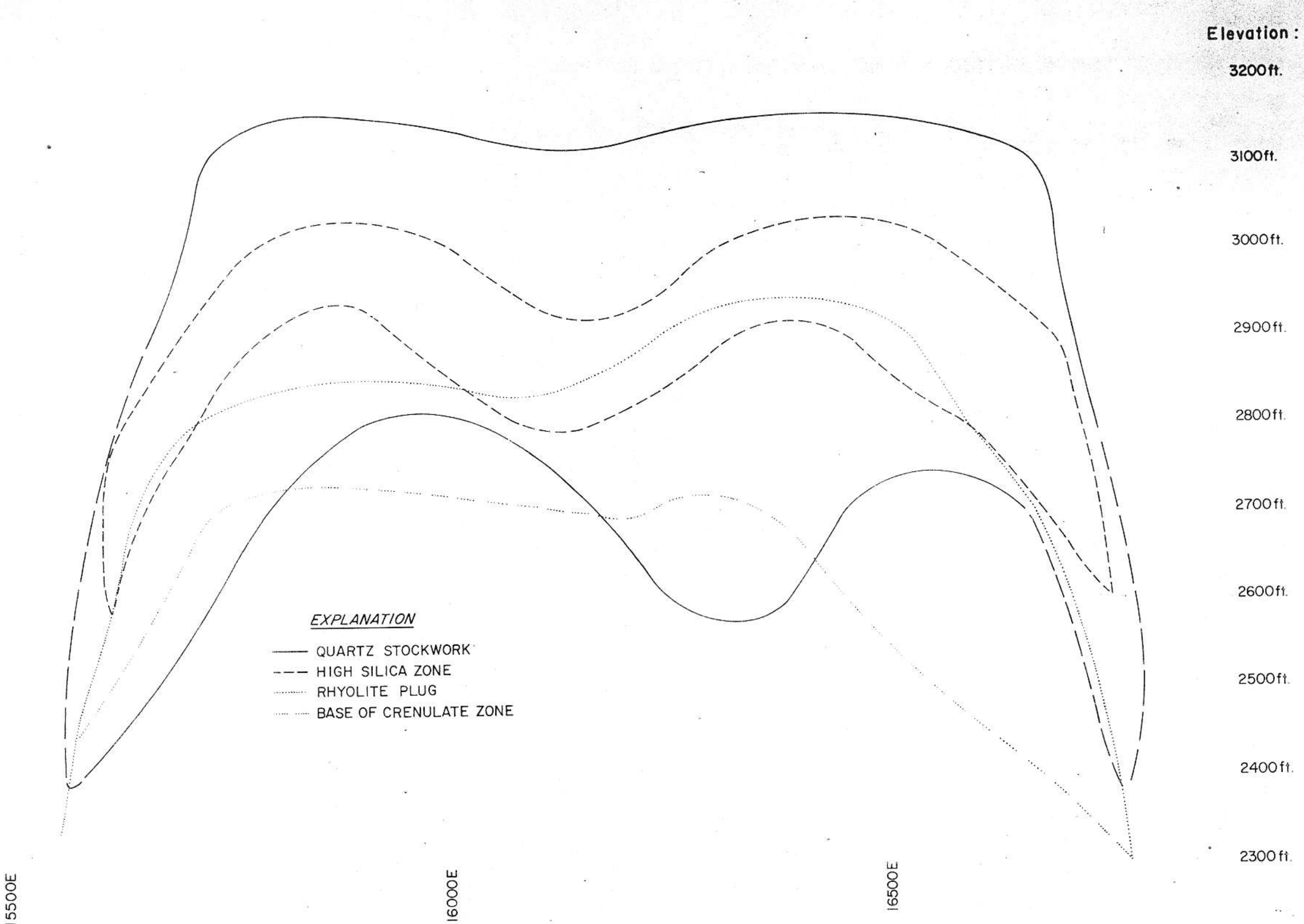


FIGURE 3.8. YORKE-HARDY 17000 N CROSS SECTION TO SHOW QUARTZ STOCKWORK, HIGH SILICA ZONE, RHYOLITE PLUG AND CRENULATE ZONE.

The rhyolite plug is characteristically a porphyry with a 100 foot wide irregular chill zone and crenulate quartz zones. It is cross-cut by intermineral rhyolite porphyry dykes (Table 3.2). The porphyry has 20 percent phenocrysts which include glassy quartz eyes to 5 mm, these are commonly mosaics of 2 to 5 euhedral crystals, white or buff subhedral K-felspar and plagioclase laths to 5 mm both of which are typically dusted with and maybe totally replaced by sericite. The groundmass consists of plagioclase, K-felspar and quartz and varies texturally from fine grained hypidiomorphic-granular to fine grained allotrimorphic-granular with rare micrographic intergrowths. Modal analysis (Bright and Jonson, 1976) indicates the porphyry is 25 percent quartz, 37 percent K-felspar, 37 percent plagioclase and 1 percent biotite and/or amphibole. Plagioclase is albite (An_2 to An_5) (DDH 38, 3038 feet, 3104 feet, Steininger, 1975). Moyer (1966) reports traces of pale brown garnet.

The majority of the chill zone occurs as aphanitic relics within the high silica zone. It is generally non-porphyritic although rare pin point quartz phenocrysts are found. With depth, quartz and felspar phenocrysts become larger and more abundant and groundmass becomes phaneritic and eventually aplitic.

The upper margin and patches of the plug are characterised by 1-2 mm crenulate quartz bands (Figure 3.7 and

3.8) inter-layered with 1-5 mm thick layers of rhyolite porphyry. Quartz within the bands is subhedral to euhedral with well terminated crystals that are unidirectional. In thin section quartz bands usually have undulatory extinction. The bands are contorted into complex minor folds with thinning and thickening on limbs and hinges respectively, this is especially impressive where deformation has occurred around phenocrysts. The bands are interpreted as late magmatic (Kamilli and Kamilli, 1979, Dowsett and Baker, 1979) as supported by evidence from quartz crystal terminations which suggest bands grew into yielding material (magma/mush of rhyolite porphyry) and plastic-style deformation indicative of magmatic temperature.

The rhyolite plug and country rocks are cross-cut by numerous rhyolite dykes (Table 3.2) which closely resemble the main plug. However, the dykes are readily recognised by chill contacts and cross-cutting relationships indicate their intermineral character. The margin of the plug is brecciated. Collapse breccias extend from the granodiorite sheet and Hazelton volcanic rocks into the plug. Breccia matrix is variable including vuggy quartz and rhyolite. Fragments are angular and include rhyolite porphyry, crenulate quartz and chill zones of the plug, rhyolite dykes, high silica rock, rhyolite and country rock cut by quartz stockworks, granodiorite sheet and Hazelton volcanic rocks. Many fragments contain Type I molybdenite veins. Some rhyolite dykes cross-cut these breccias and Type I veins, others are recognised as fragments, thus there are varying ages of dyke emplacement.

Intrusion of the plug was complex, resulting in movements that produced a series of breccias, at least two stages of dyke emplacement and a silica rich hydrothermal solution that obliterated some rock textures and formed stockworks. The majority of molybdenite veins were formed prior to intrusion of the plug which generally contains low MoS_2 values (less than 0.05 percent MoS_2). Neither MoS_2 values nor alteration other than silicification appear to mimic the shape of the rhyolite plug.

Hudson Bay Mountain Stock

The Hudson Bay Mountain Stock, also called the quartz monzonite stock, has been intersected in four diamond drill holes (Table 3.3). Its presence was inferred prior to intersecting the stock for the following reasons:

1. A subradial swarm of quartz-felspar porphyry dykes, centered beneath the glacier are exposed at the surface (Figure 3.1) and are observed in core (Table 3.3). They are interpreted as genetically related to the stock.

2. Domal uplift is interpreted from geologic mapping and from air photo mosaics.

Table 3.3 - Yorke Hardy Hudson Bay Mountain Stock Drill Hole Intersections

DDH	28	67	70	72
Inclination and Bearing	-60°SE	-60 to -30° SE	-47 to -5° W	-90
Collar Location	19116N 12625E 5626' elev.	17395N 15017E 3510' elev.	17397N 14994E 3511' elev.	17104N 16108E 3507' elev.
Base Location	18102N 13636E 3175' elev.	15408N 15764E 1504' elev.	18071N 12558E 2054' elev.	17121N 16159E 1097' elev.
Total Footage	2851	3006	3103	2305
Year Drilled	1963	1967	1968	1968
Depth of Intersection	2782	2370	1075	2181
Intersection Location	18130N 13618E 3236' elev.	15955N 15652E 1800' elev.	17316N 14222E 2773' elev.	17111N 16142E 1331' elev.
Footage in Stock	69	296	2028	294
Angle of contact (corrected)	80°	75°	60°	85°
Host rocks	Black to purple porphyritic flow. Euhedral felspars are aligned, groundmass is aphantic.	Dark grey andesite tuff	Dark grey crystal tuff	Rhyolite quartz porphyry plug
Contact effects within intruded rocks	12 0.3-3 metre quartz felspar dykes, numerous 1-5mm fine grained pink dykes occur up to 50' distance from contact. Bleaching as halos enveloping numerous Qz+K-fel$\pm$Py$\pm$$MoS_2$ and rare fluorite veins.	No dykes. Some bleaching, results in blotchy texture. Numerous Qz+K-fel$\pm$Py$\pm$$MoS_2$ and rare fluorite veins.	One 3 metre quartz felspar dyke. Numerous Qz+K-fel$\pm$ Py$\pm$cpy$\pm$$MoS_2$ and rarely fluorite. Bleaching as halos.	One 0.3 and one 6 metre quartz felspar dyke. Quartz-fluorite veining.
Contact effects in stock	5 mm pink chill. Groundmass is aphanitic to fine grained for 10 meters into stock.	3 cm banded zone of coarse grained fluorite, quartz, and K-felspar with disseminated MoS_2 and cpy.	3 mm pink chill, groundmass is fine grained for 10 metres into stock.	(contact missing from drill core)
Stock Description	Pink & white fine to coarse grained porphyry, consisting of strongly zoned plagioclase (An_{25})(38%); quartz (35%); perthitic K-felspar (21%); & biotite (2-3%). K-spar phenocrysts to 5 mm, quartz eyes to 2 mm, comprise 52% of the rock.	7 ft pink porphyry (as 28) 0.3 ft pink 'felsite' (as 28 chill zone). Remainder is gradational grey to dark grey fine to medium grained porphyritic to equigranular granodiorite and tonalite. Felspar phenocrysts to 3 mm.	Pink & white porphyritic granite with pink (10mm) & white (5mm) felspars, quartz eyes (to 3mm) and (2mm) biotite & hornblende. Phenocryst content 20-50%. Felspar (white) are zoned. Accessory minerals are pyrite, magnetite and occasionally fluorite. 70-119 plagioclase composition, core An_{16}, rim AN_{12}, 70-3102 core An_{12}, rim An_{10}.	As in DDH 70.

3. Increase of thermal metamorphism including development of garnet with depth, is observed in thin section (Sutherland-Brown 1958).

The stock and quartz-felspar porphyry dykes cross cut all rock types and Type I molybdenite veins. On surface, dykes are cut by rare Type II molybdenite veins. Jonson et. al. (1968) state therefore that the stock is late intermineral. There is a sharp decrease in both intensity of fracturing and MoS_2 content upon entering the stock (Atkinson 1980). Contact of the stock with intruded rocks is sharp and marked by a narrow (to 1 cm) chill zone in the stock. K-Ar ages for the stock and associated dykes (Table 3.4) give an Upper Cretaceous-Lower Tertiary age.

Table 3.4 - K-Ar Age Dates for the Hudson Bay Mountain Stock and Quartz-Felspar Porphyry Dykes

Stock
67 ± 5 m.y. (Kirkham 1966, DDH 28, 2782-2851, biotite)
73.3 ± 3.4 (Carter, 1974, DDH 28, 2782-2851, biotite)
Dyke
60 ± 5 m.y. (Kirkham, 1966, surface, biotite)

The stock may be interpreted as either a composite body containing phases that vary from a pink and grey quartz monzonite porphyry to an equigranular granodiorite (Table 3.3, Figure 3.9) or as two separate stocks. Quartz monzonite and quartz monzonite porphyry found in drill holes 28, 70 and 72 are very similar

(Table 3.3). Both are characterised by phenocrysts including euhedral pink, 1 - 10 mm K-felspars, white or buff, 3-5 mm well zoned plagioclases (An_{10} to An_{16}, Steininger 1975) with albitic rims, glassy 2 mm quartz often with quartz overgrowths and 2 mm hornblende and biotite flakes. The groundmass is fine to coarse grained quartz and felspar with granitic texture and some granophyric intergrowths rimming both quartz and felspar crystals. Accessory minerals include pyrite, magnetite, sphene, monazite and fluorite.

In contrast, the southeasterly part of the stock intersected in DDH 67 is grey and varies texturally from equigranular to porphyritic. As compared to other rocks, this part of the stock contains less quartz and more mafic minerals and plagioclase (Table 3.5) and may be a separate intrusion. Composition ranges from tonalite through granodiorite to quartz monzonite (Figure 3.9).

The stock commonly contains xenoliths of fine to medium grained, light grey, biotite rich rocks which may be sedimentary or volcanic. Dark grey coloured, porphyritic dykes cross cut the stock. Modal analyses (Appendix 1, Figure 3.9) show these porphyritic dykes are granitic in composition.

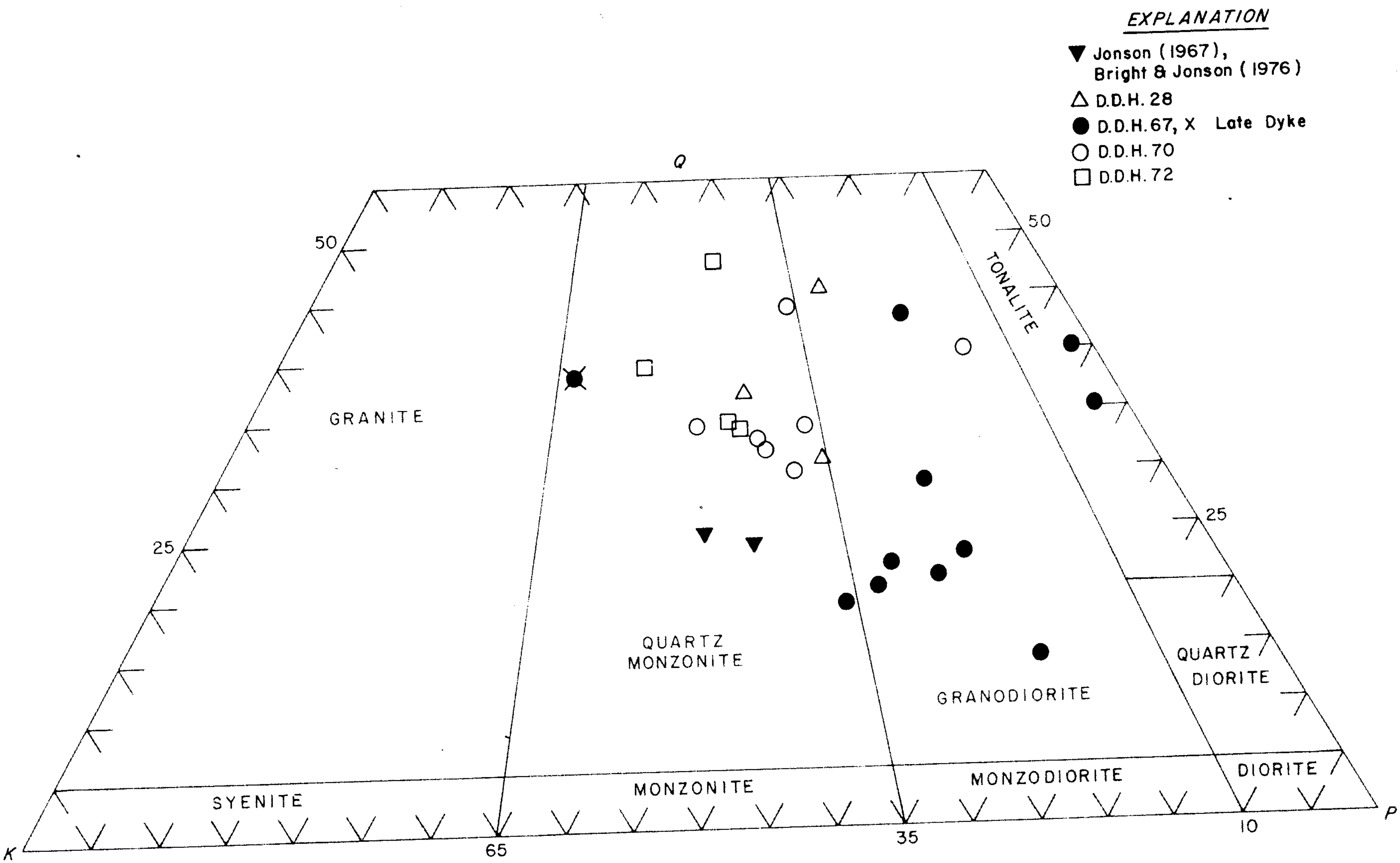


FIGURE 3.9. YORKE-HARDY HUDSON BAY MOUNTAIN STOCK TERNARY MODAL PLOT FOR QUARTZ-K-FELDSPAR-PLAGIOCLASE (CLASSIFICATION MODIFIED AFTER HUTCHISON, 1970.)