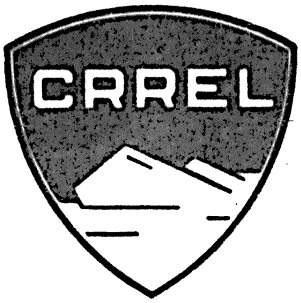
SR 150



Special Report 150

CAMP CENTURY REVISITED
A PICTORIAL VIEW-JUNE 1969

Austin Kovacs

July 1970

CORPS OF ENGINEERS, U.S. ARMY
COLD REGIONS RESEARCH AND ENGINEERING LABORATORY
HANOVER, NEW HAMPSHIRE

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DA TASK 1T062112A13001

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ILLUSTRATIONS

ILLUSTRATIONS (Cont'd)

ILLUSTRATIONS (Cont'd)

CAMP CENTURY REVISITED

A Pictorial View - June 1969

by

Austin Kovacs

Camp Century, Greenland, constructed in 1959 and abandoned in 1966, was revisited between 22 May and 2 June 1969. Photographs were taken of local surface features and of conditions existing within the buried camp complex. The effects of trench closure are dramatically shown. Comments on each view are limited, however, to picture location and generalities. For detailed histories of Camp Century and analysis of the causes of trench deformation leading to the events illustrated, the *Selected Bibliography* on p. 53 should be consulted. However, for a general comparison with conditions at the camp complex in 1960 and 1962 five photos from USA CRREL Special Report 56 (Leighty, 1963) are included in this report where the directional views are similar.

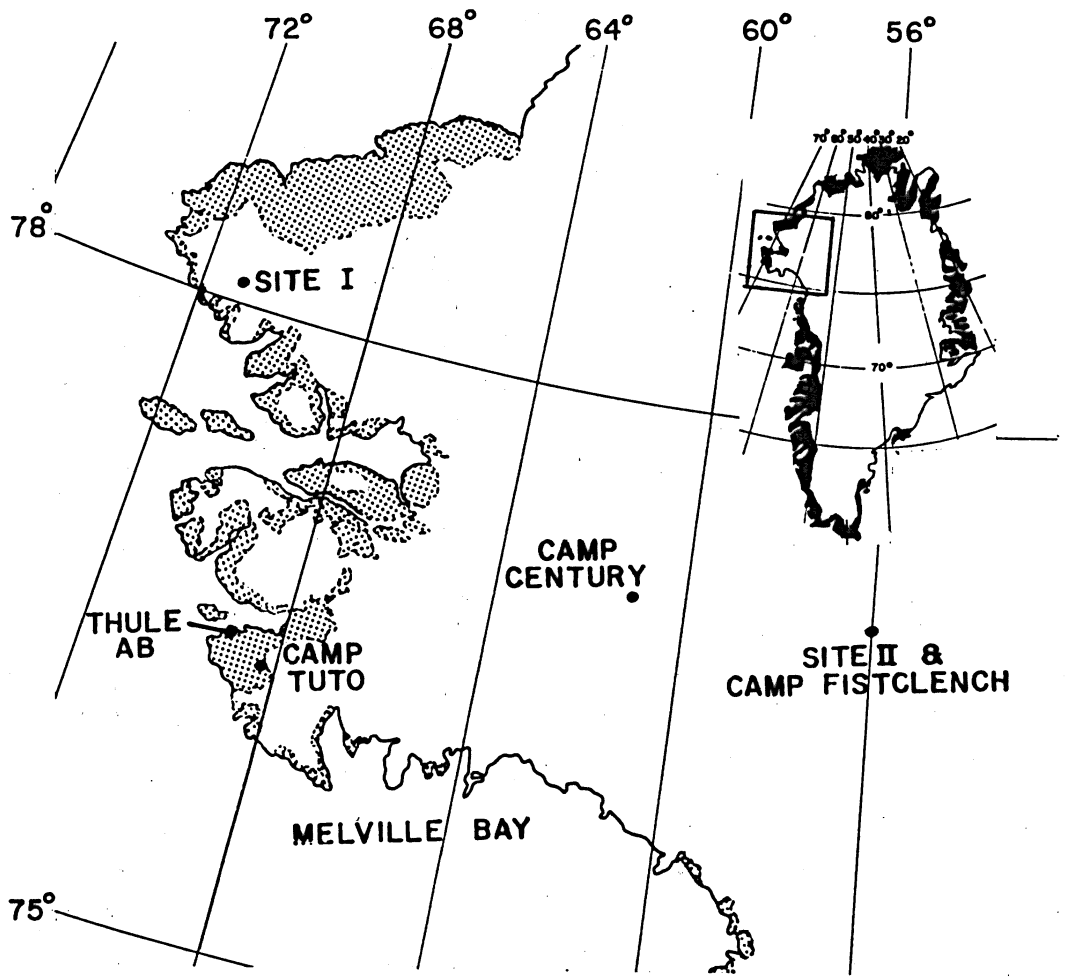

Figure 1. Location of Camp Century, Greenland.

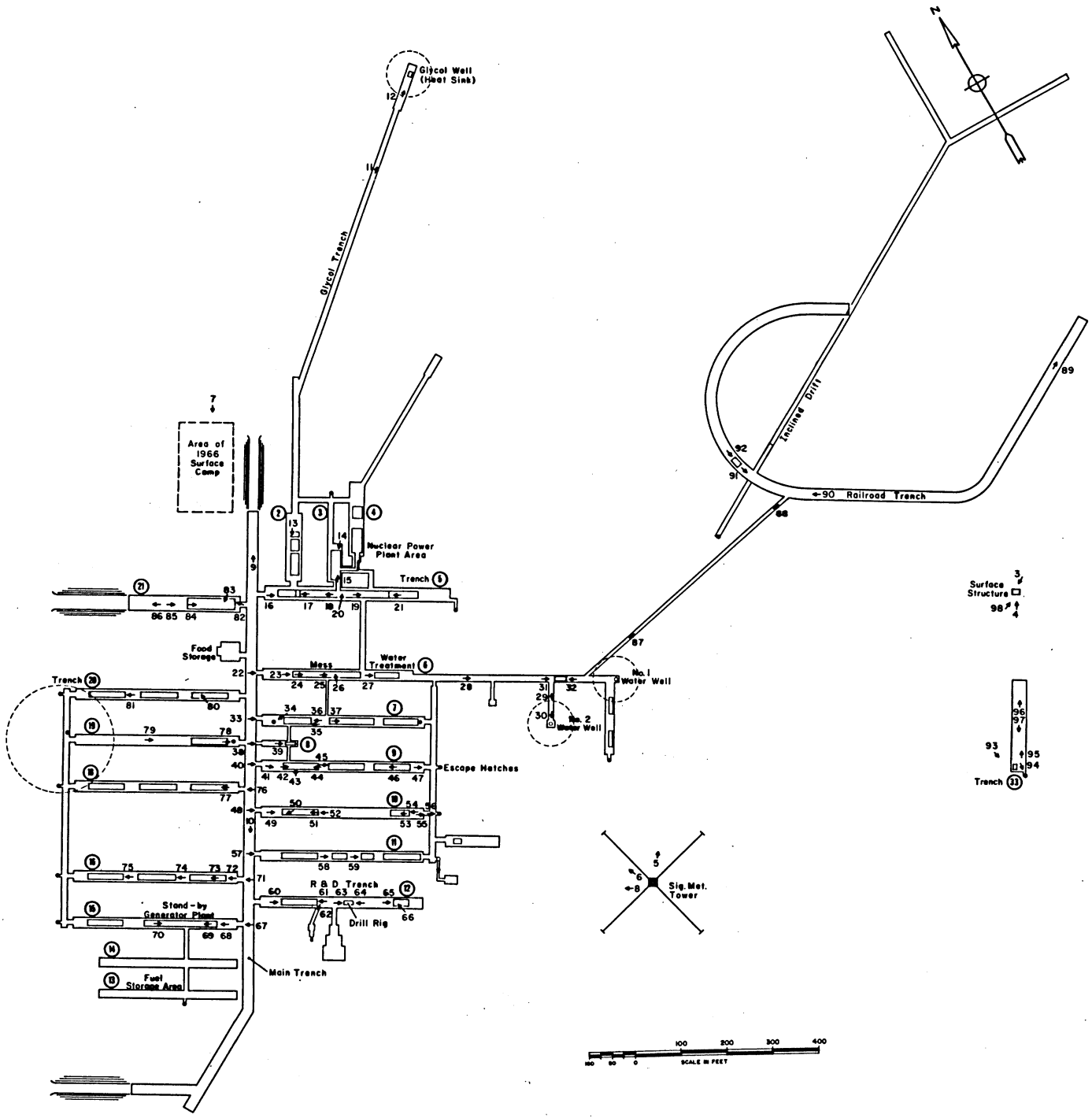

Figure 2. Plan view of Camp Century. The location of each photo in the report and the direction in which it was taken are shown by figure numbers and adjacent arrows.

Figure 3. Arrival day. The structure protruding above the snow surface was built in 1964 on piles and was at that time 12 ft above the surrounding snow surface (see Fig. 4). This facility was occupied by the 1967 and 1969 field parties. In the background is the Sig. Met Tower.

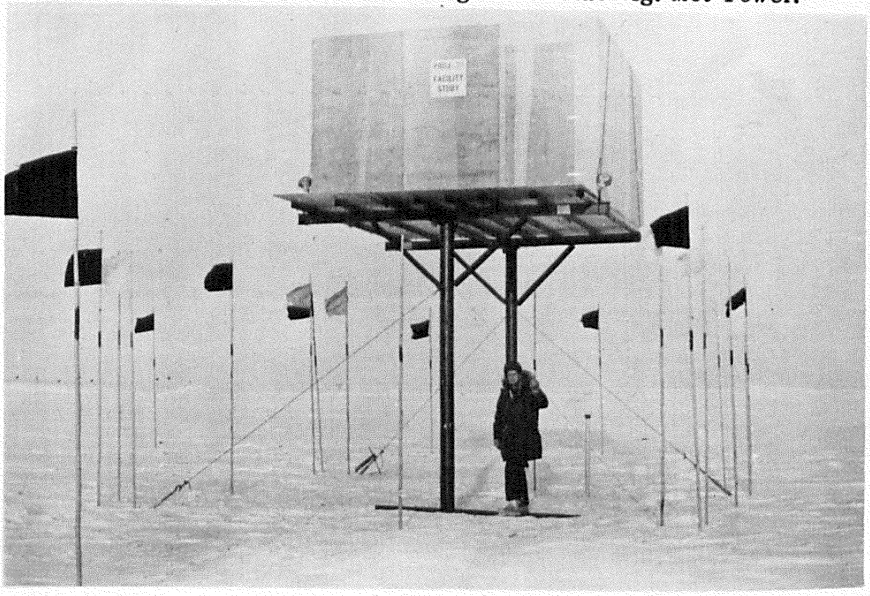

Figure 4. View of the above-surface structure in 1964. Poles were used to measure snow accumulation.

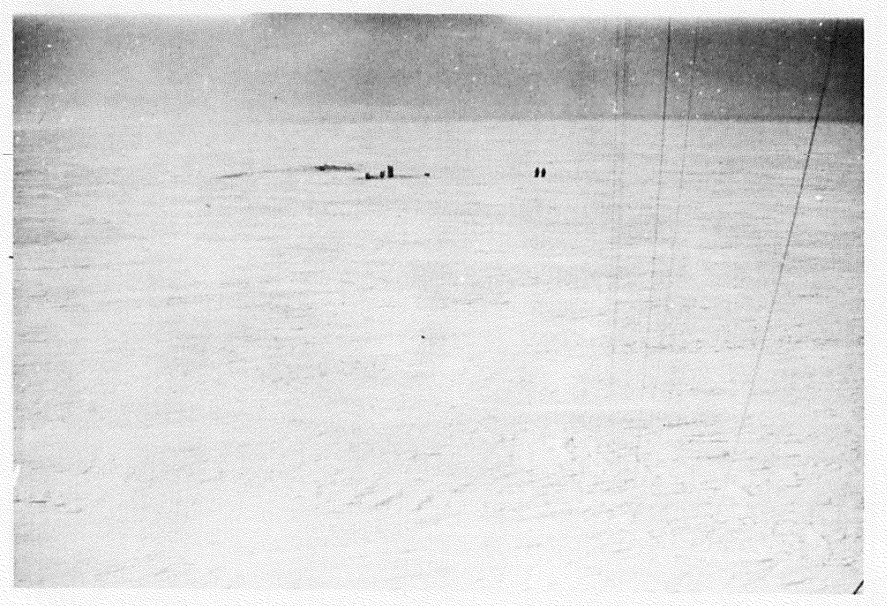

Figure 5. Escape hatch access to inclined drift.

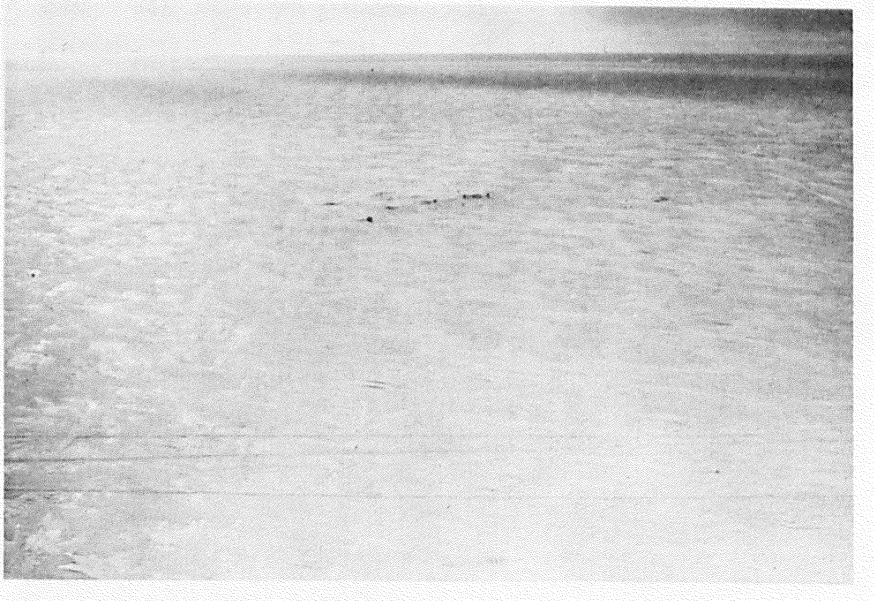

Figure 6. Smoke stacks protruding through the snow mark the wanigans of the 1966 surface camp.

Figure 7. Area of the 1966 surface camp. This camp consisted of three wanigan trains and a T-5 building.

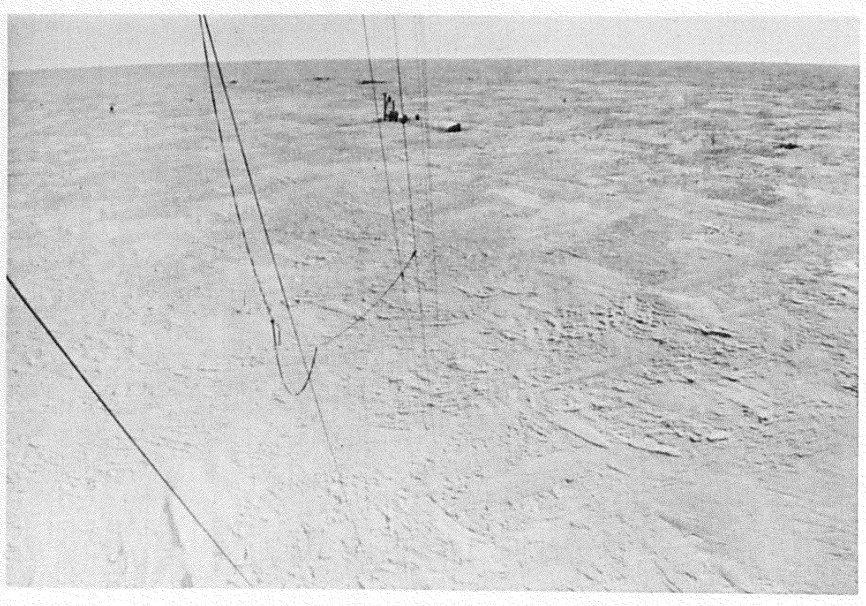

Figure 8. Aluminum tower over borehole drilled to the bottom of the ice cap. Tower sits over drill rig located in Trench 12.

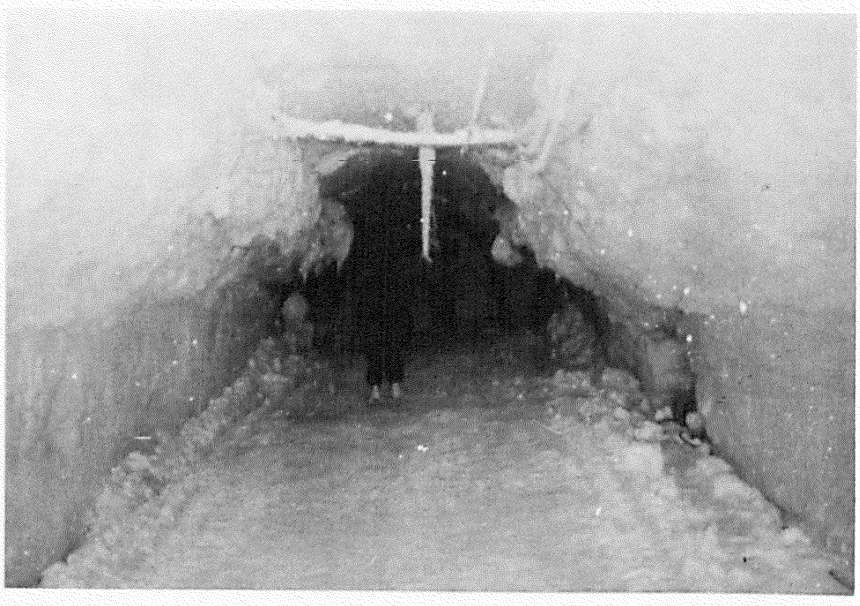

Figure 9. Barricade at north end of main trench.

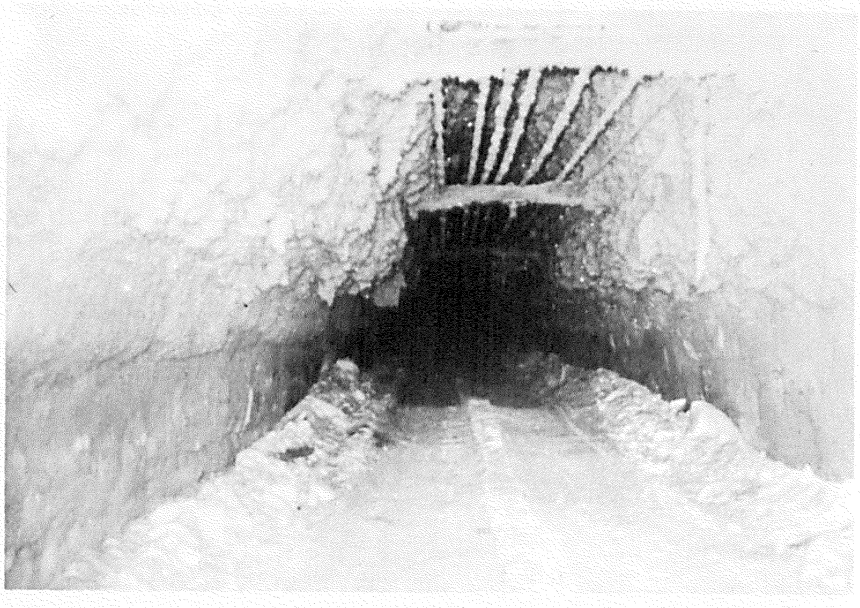

Figure 10. View of main trench.

Figure 11. The glycol trench, once 9 ft wide, has undergone considerable deformation. Heat which once escaped from the glycol pipeline leading from the reactor to the glycol well and residual heat within the well increased the temperature of the surrounding snow. This in turn increased the deformation rate of the snow and accelerated trench closure.

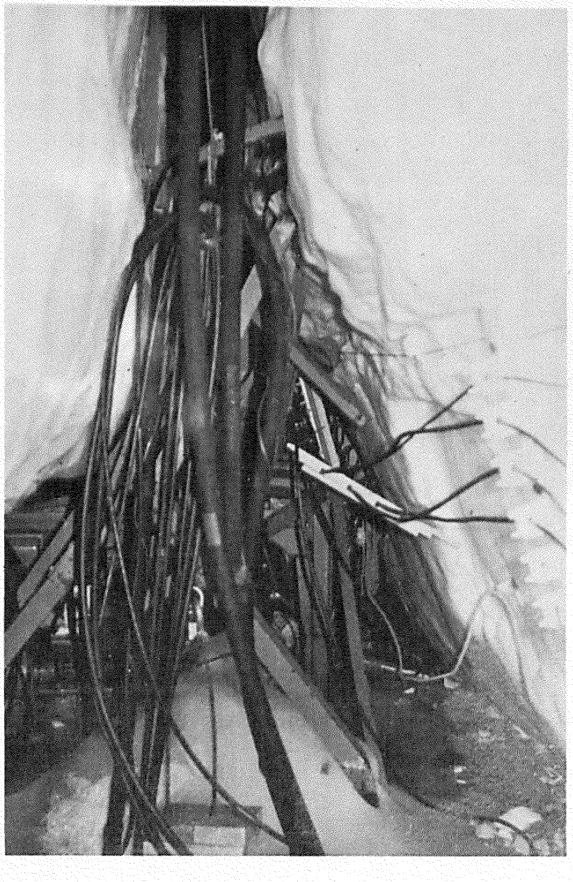

Figure 12. Snow deformation crushes the derrick over the glycol well.

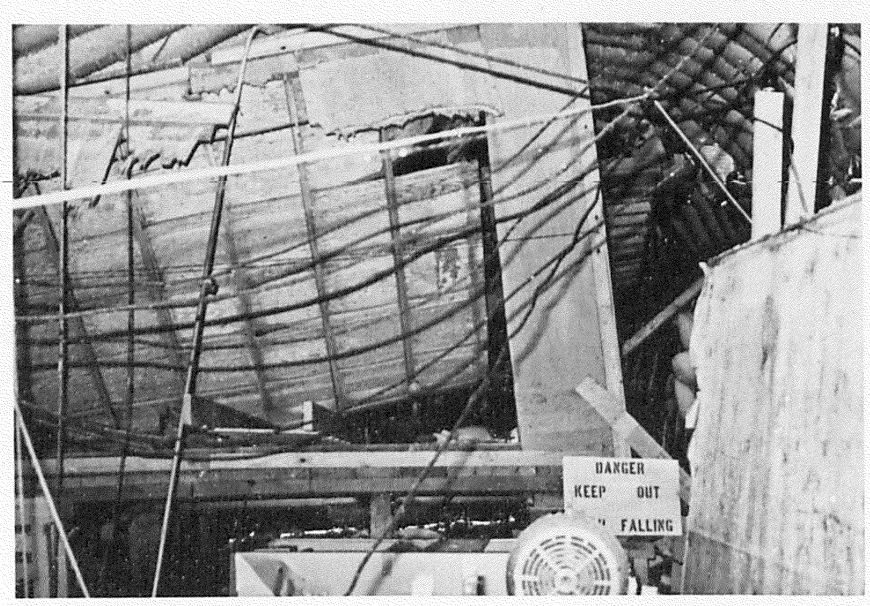

Figure 13. Snow load from above deforms metal arch, crushing wooden structure in Trench 2.

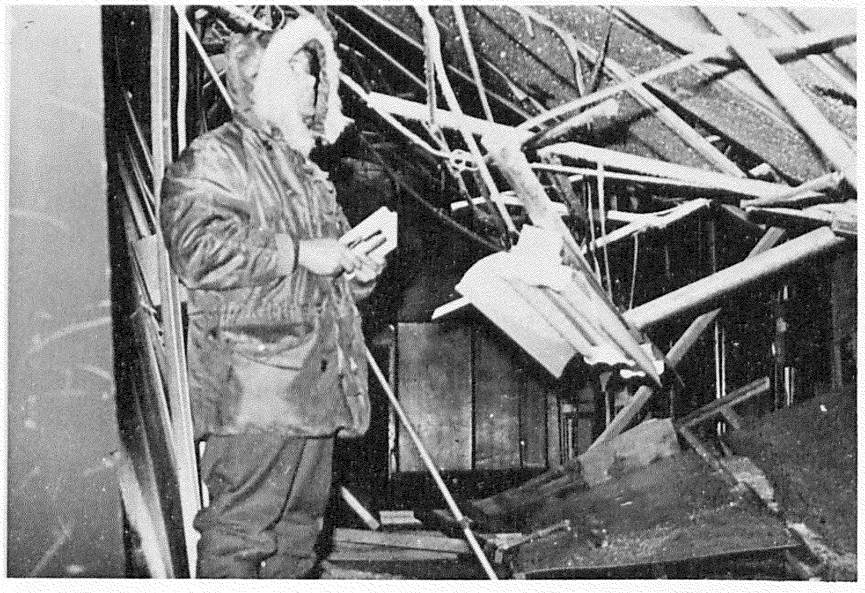

Figure 14. Crushing of wood and steel reactor building in Trench 3.

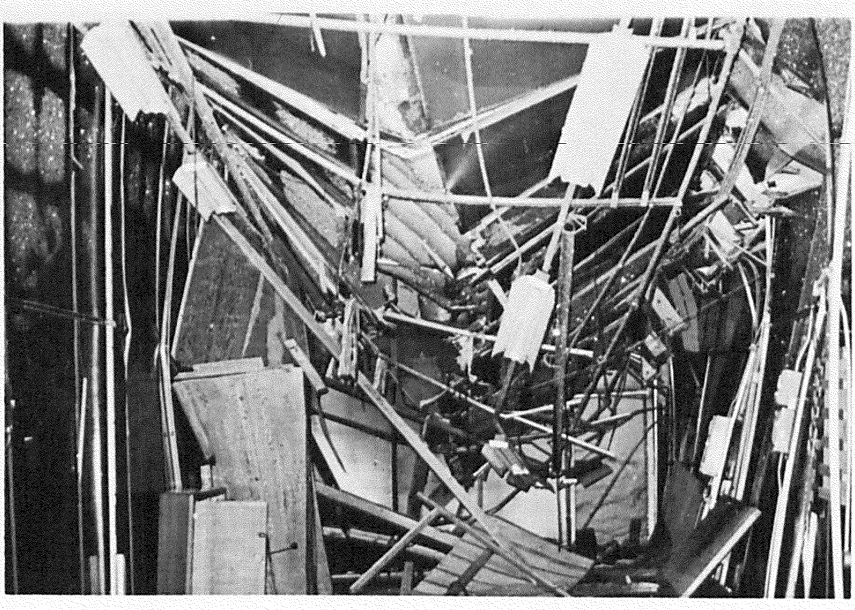

Figure 15. Snow-loaded arch pushes through roof of a reactor building in Trench 3.

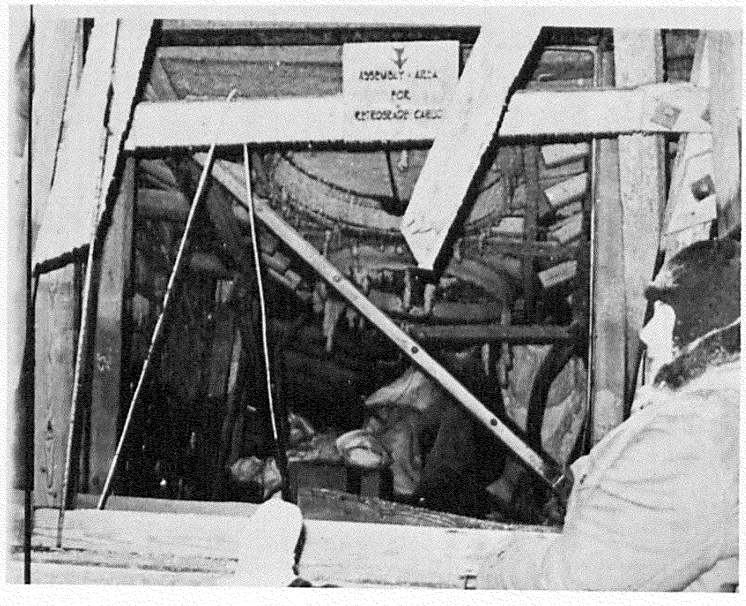

Figure 16. Heavy steel is bent and large timbers are snapped by snow pressures exerted upon the framework of an air blast cooler housing (Trench 5).

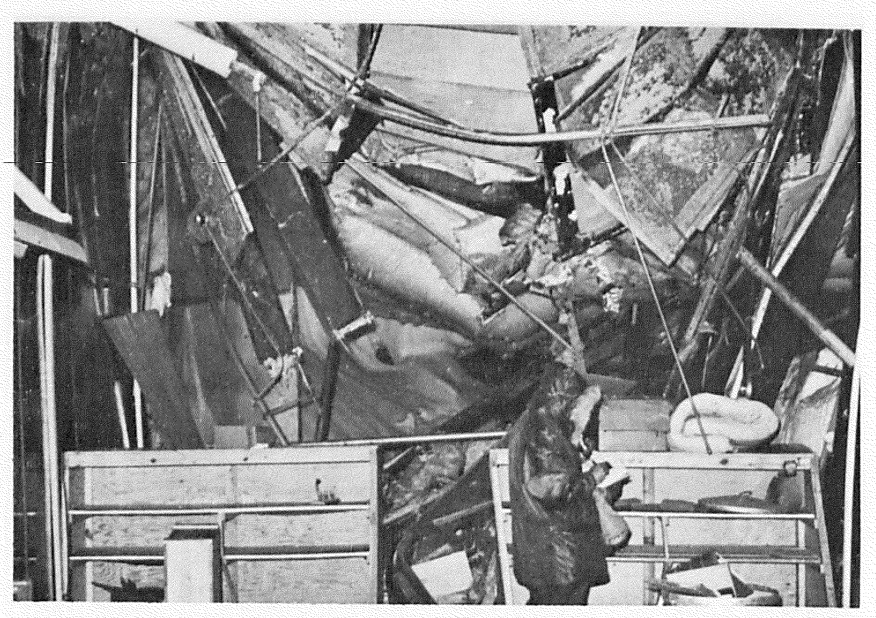

Figure 17. Metal arch pushing through roof at west end of reactor building (Trench 5).

Figure 18. Deterioration of reactor building (Trench 5).

Figure 19. Deterioration of reactor building (Trench 5).

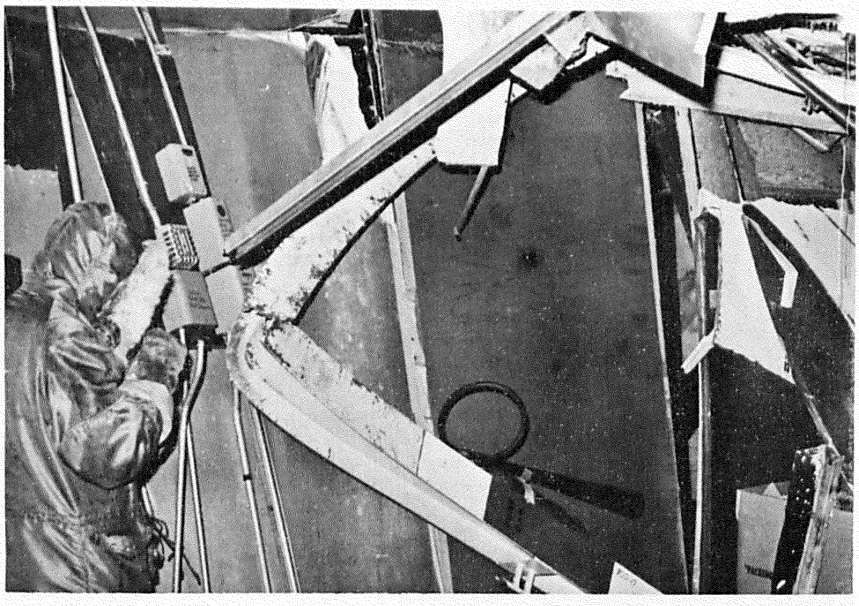

Figure 20. Torn and twisted steel (Trench 5).

Figure 21. Metal arch buckling (Trench 5).

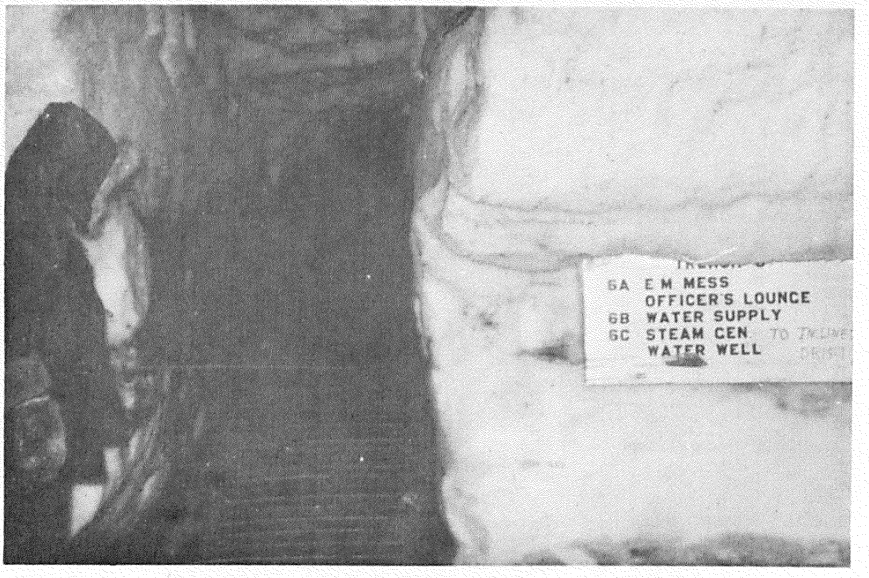

Figure 22. Entrance to Trench 6.

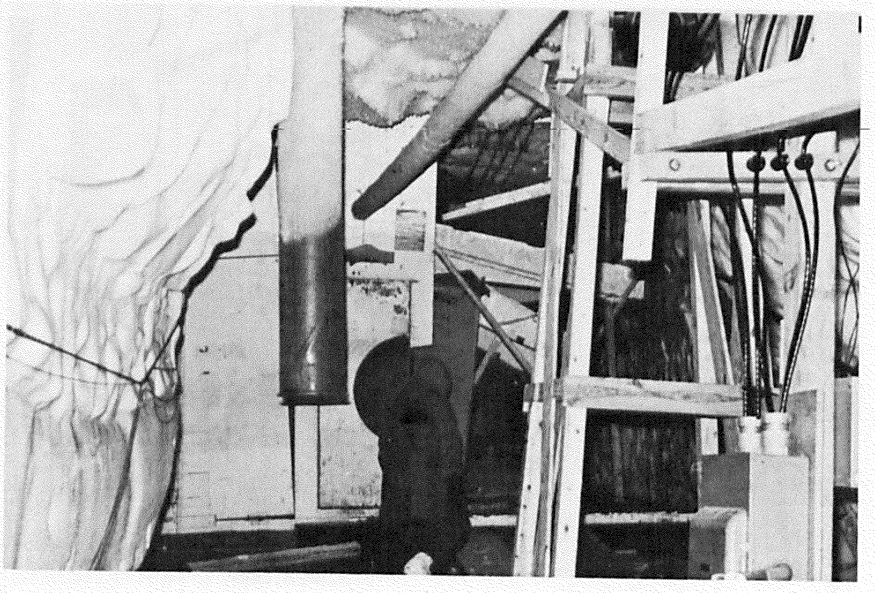

Figure 23. Entrance to mess hall.

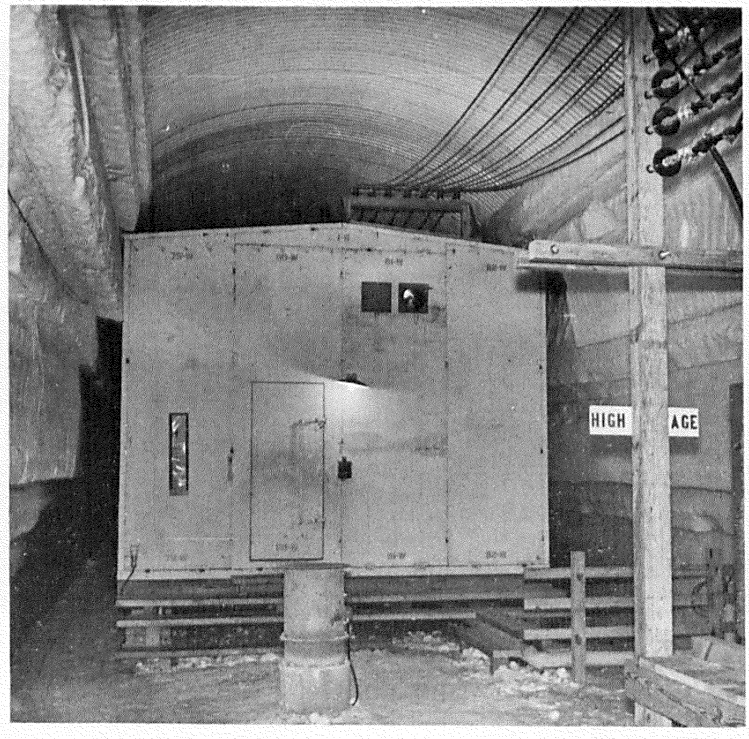

Figure 23a. A similar view of the mess hall in 1960. (From Leighty, 1963).

Figure 24. Ceiling joists pushed downward by snow encroachment upon mess hall roof.

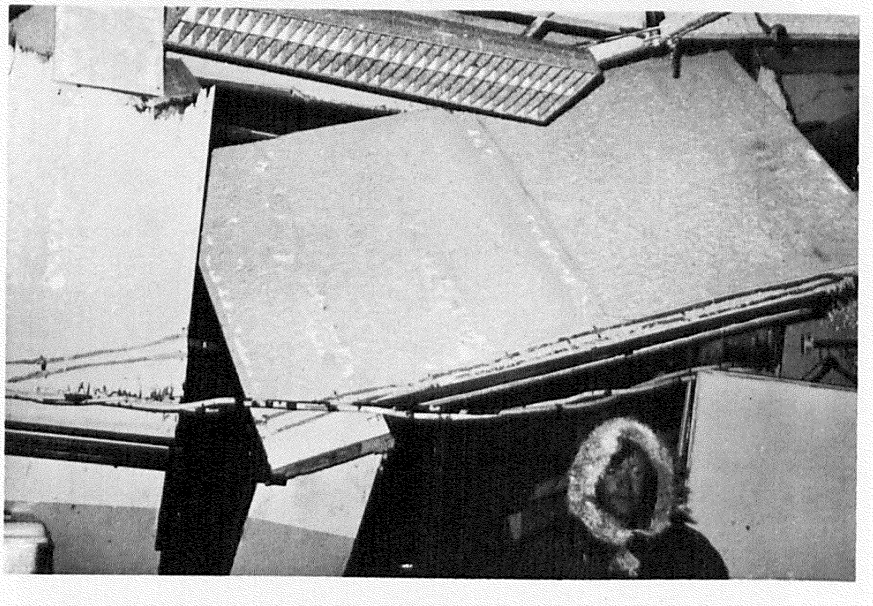

Figure 25. Wall and ceiling destruction in mess hall.

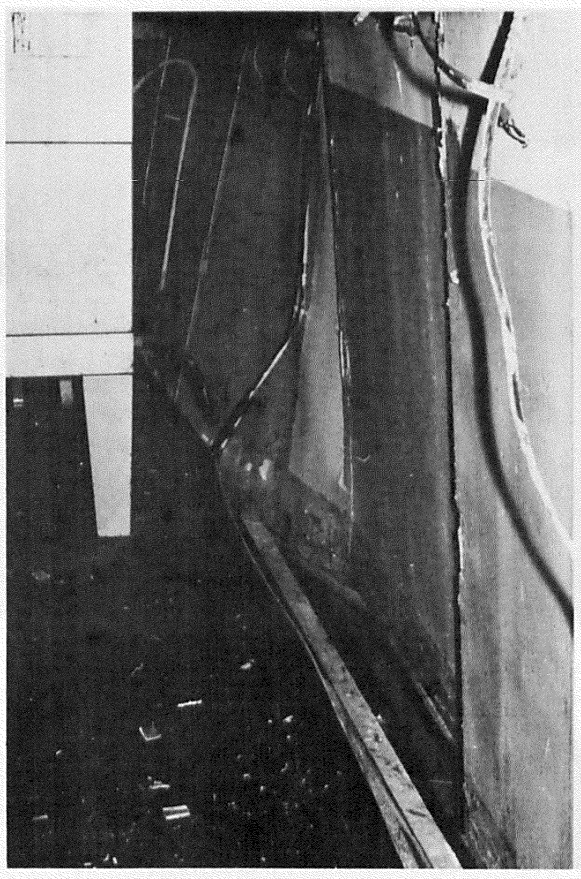

Figure 26. Displacement of wall panels in mess hall.

Figure 27. Area once occupied by water treatment and storage plant.

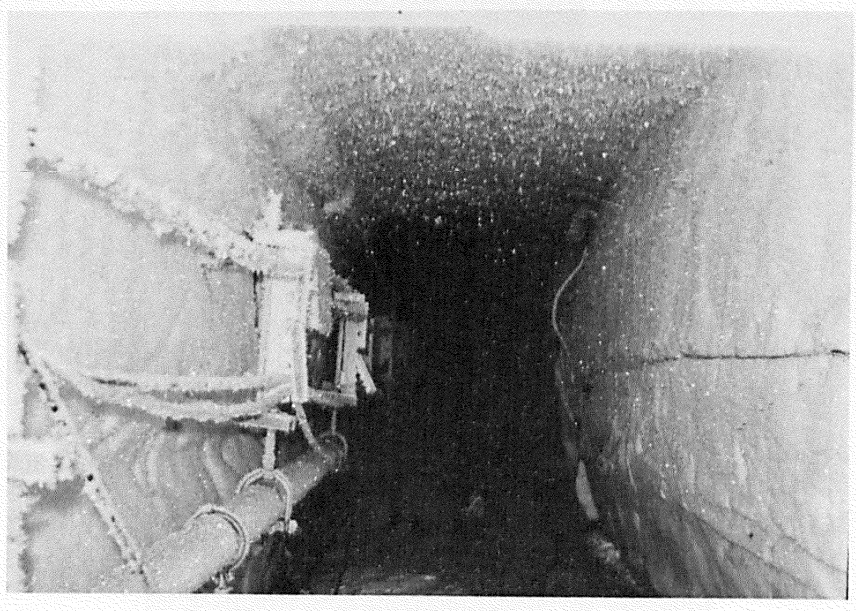

Figure 28. Trench 6 passageway to water well.

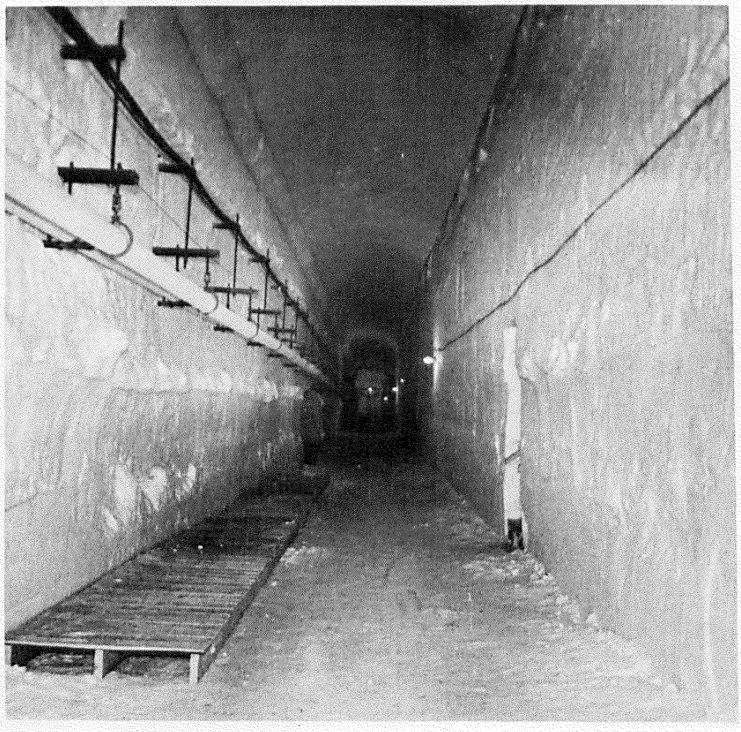

Figure 28a. Trench 6 passageway in 1960.
(From Leighty, 1963).

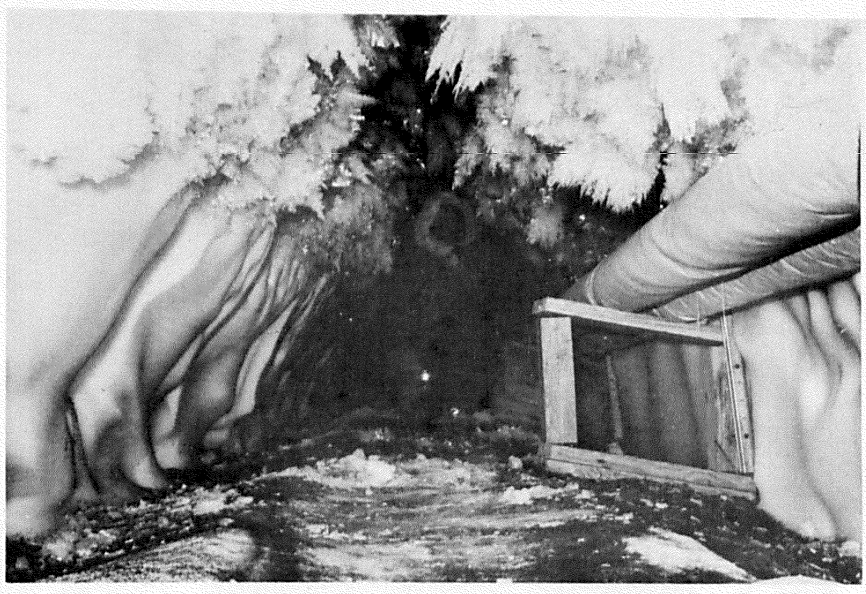

Figure 29. Where a man could once walk upright, only a crawl space exists in the passageway to water well 2.

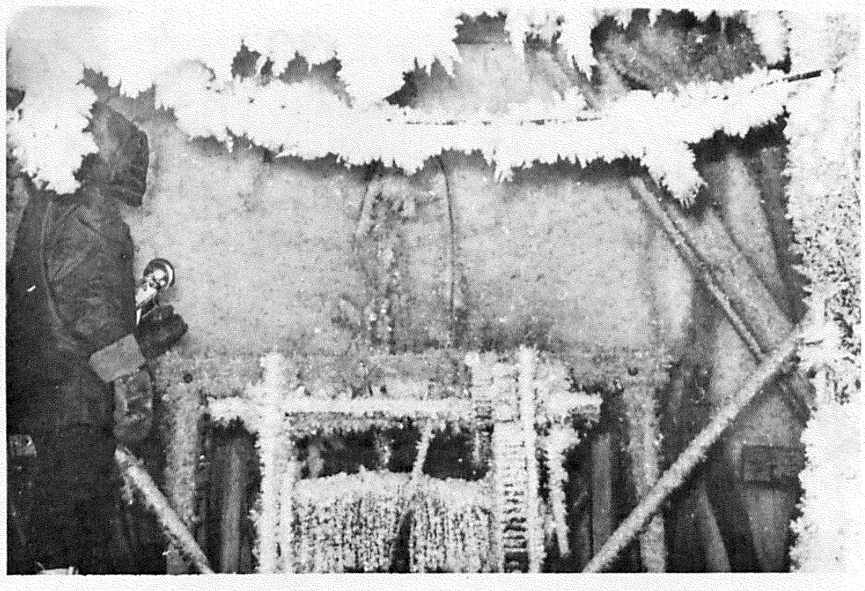

Figure 30. Hoist area at water well 2.

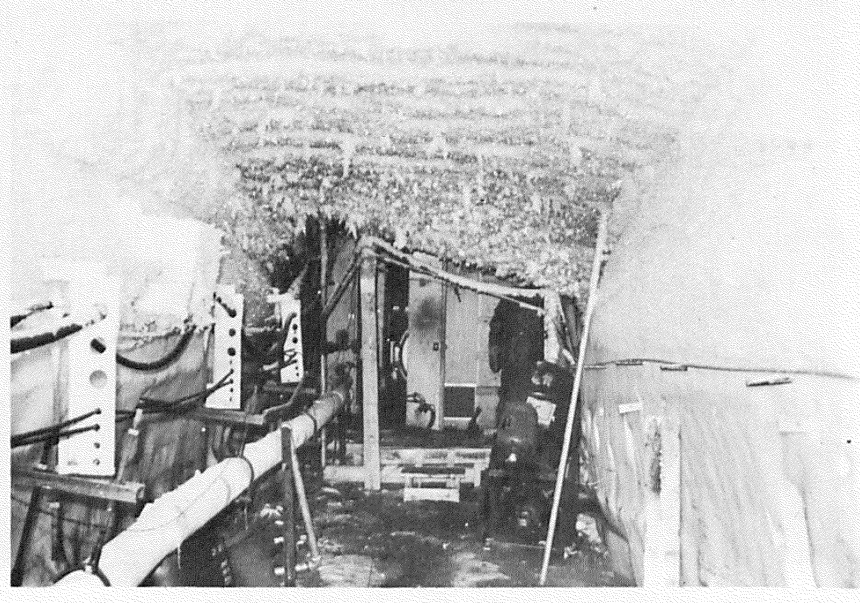

Figure 31. Steam generator building.

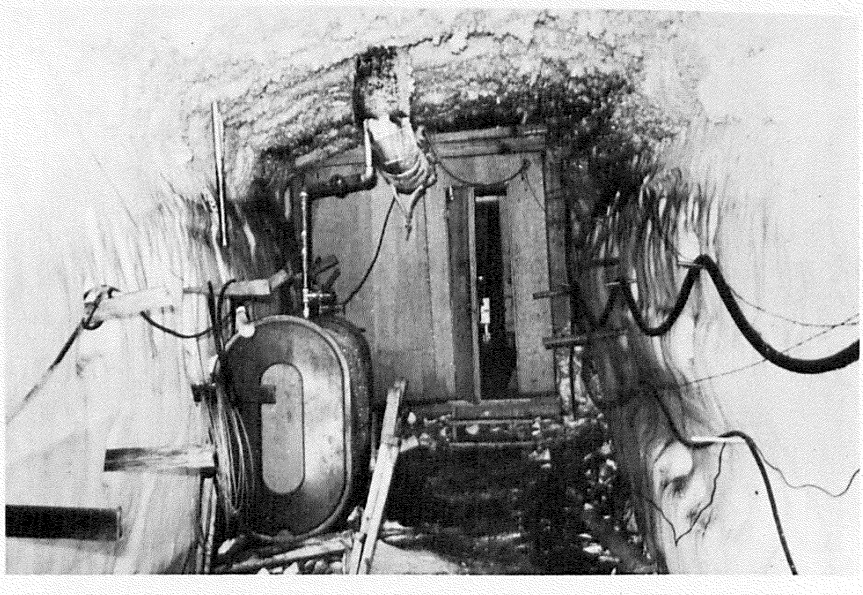

Figure 32. Rear of steam generator building.

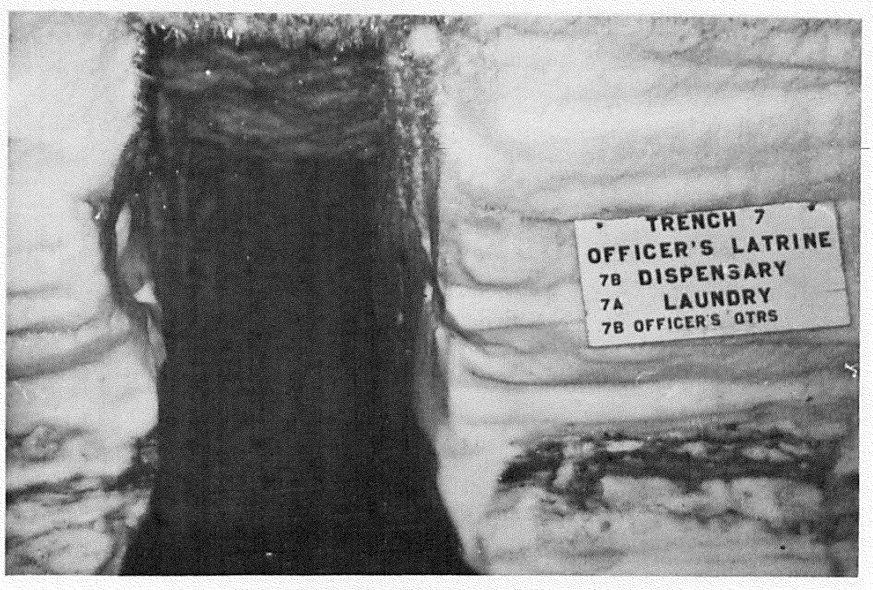

Figure 33. Entrance to Trench 7.

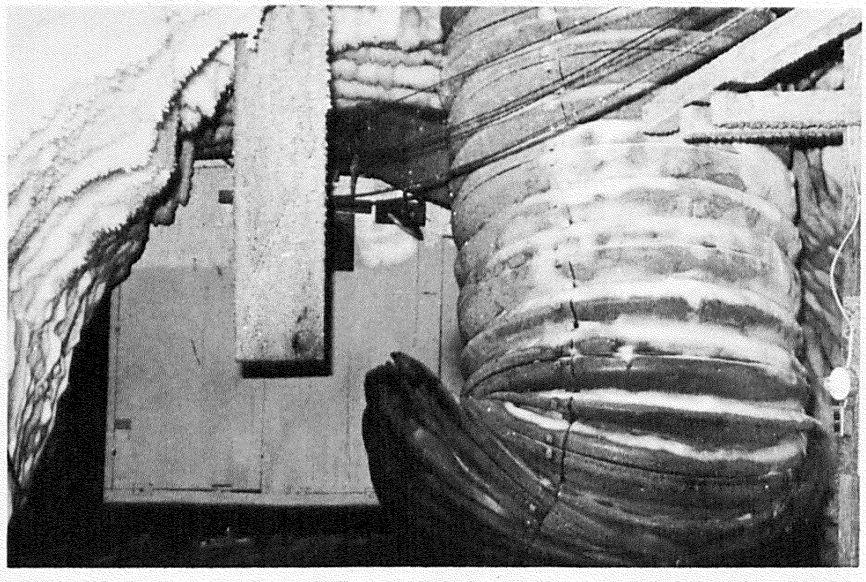

Figure 34. Metal escape tower buckled and deformed (Trench 7).

Figure 35. Trench floor arching causes board walkway to tilt (Trench 7).

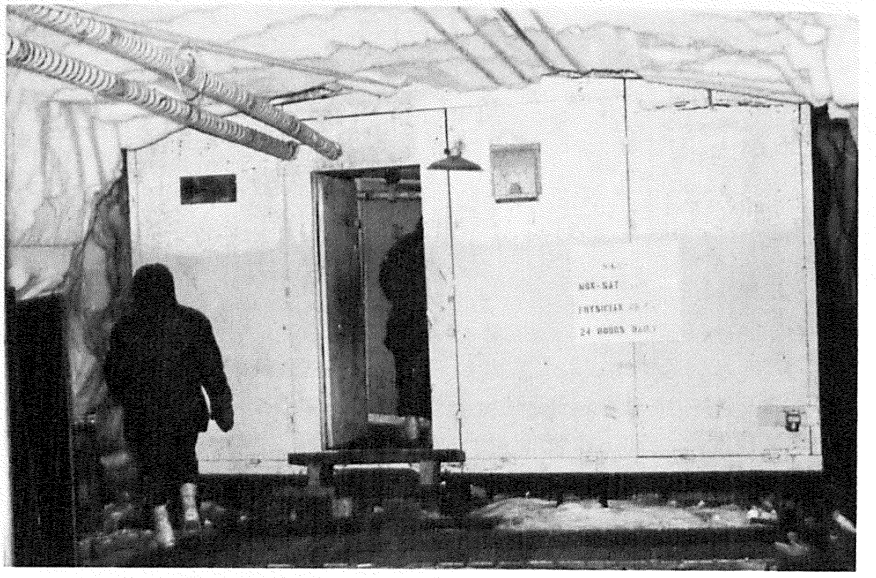

Figure 36. Entrance to laundry (Trench 7).

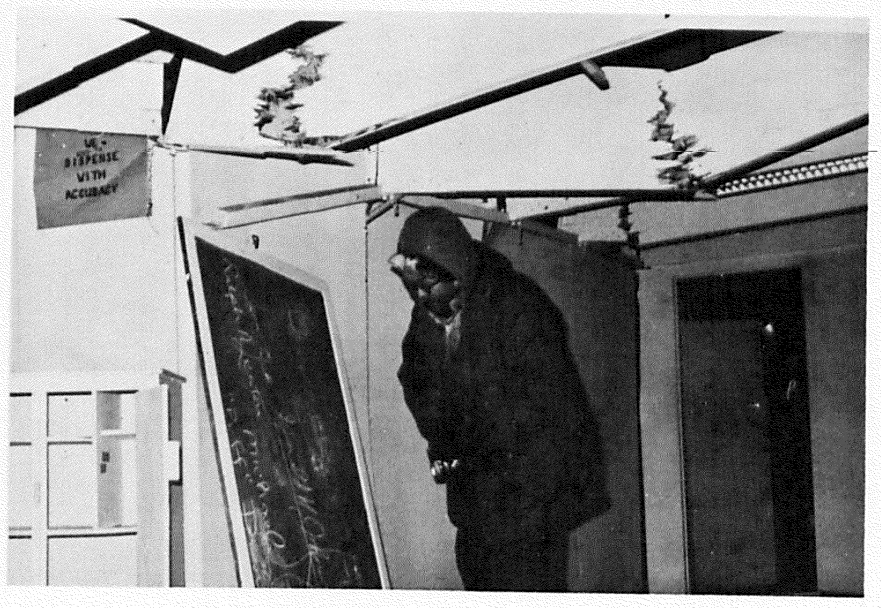

Figure 37. Overloaded ceiling joists in dispensary.

Figure 38. Entrance to Trench 8.

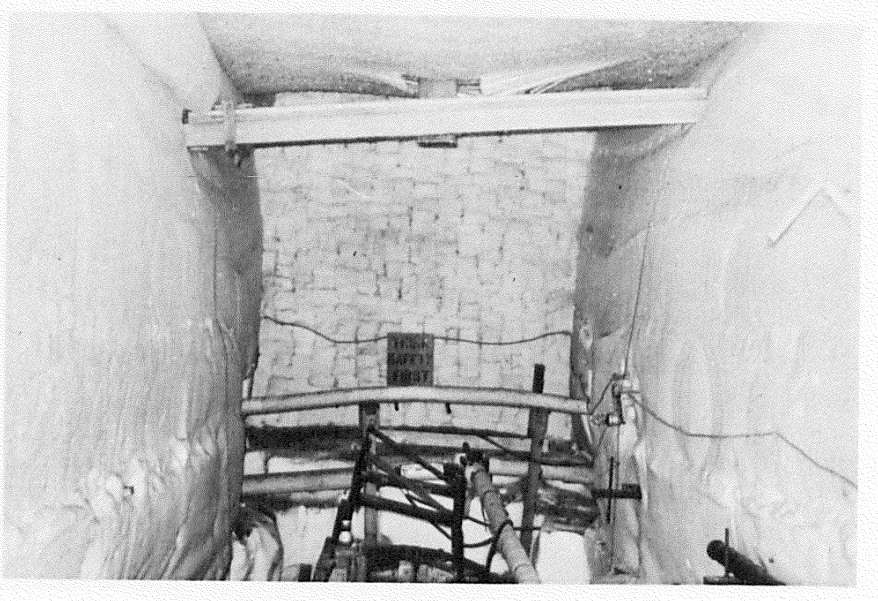

Figure 39. Snow deformation in Trench 8 causes pipeline to buckle.

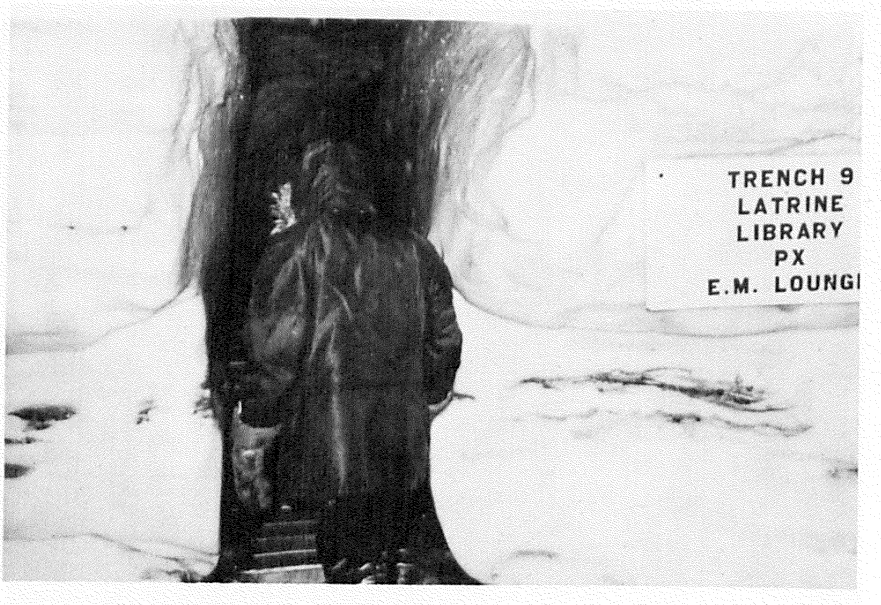

Figure 40. Entrance to Trench 9.

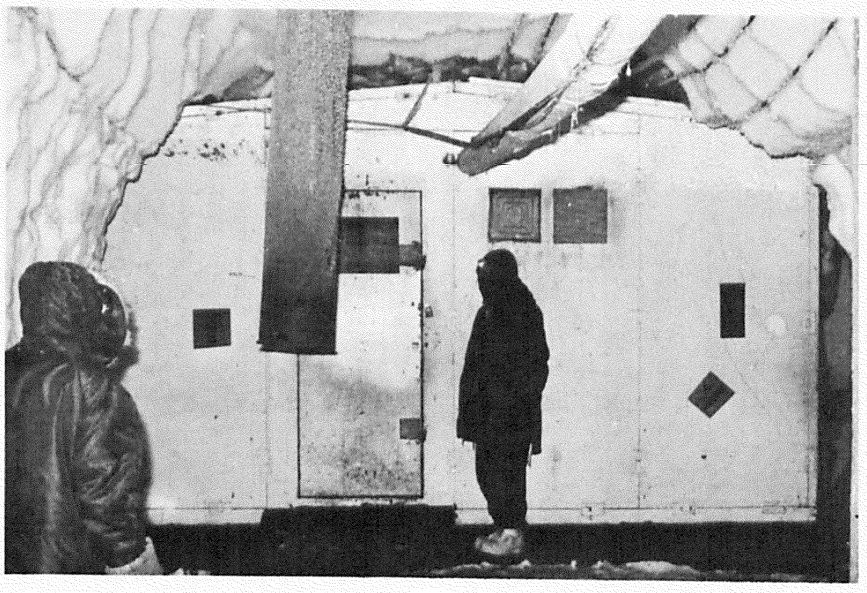

Figure 41. Entrance to EM latrine (Trench 9). Note snow encroaching upon building.

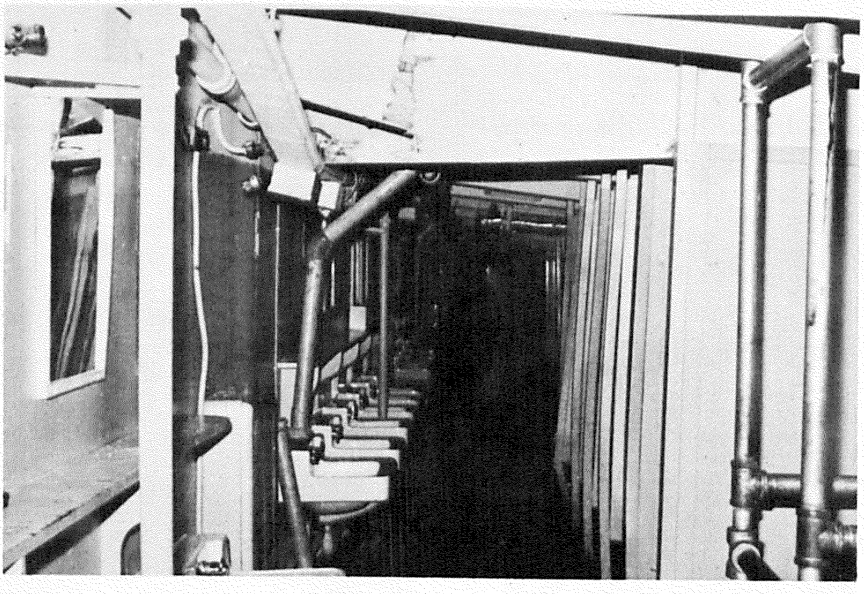

Figure 42. Broken pipes and cracked ceiling joists (EM latrine).

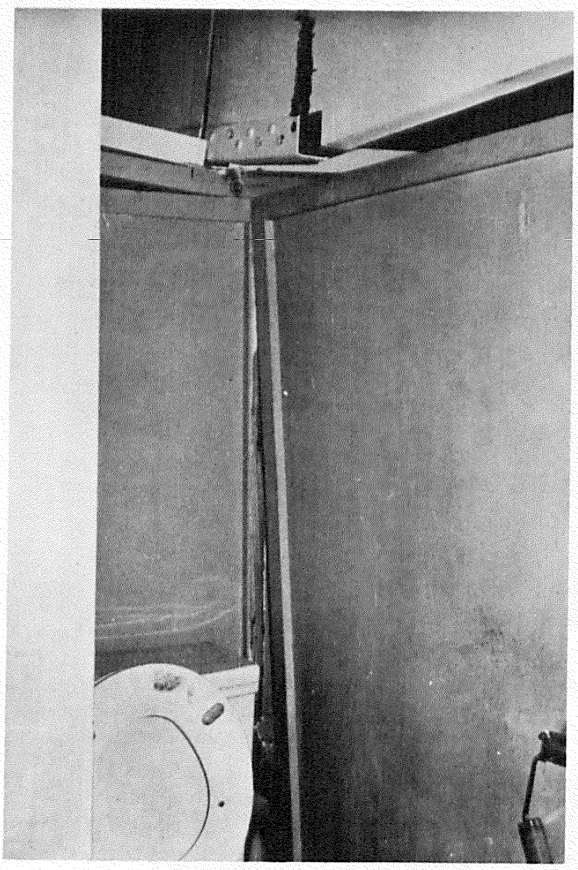

Figure 43. Ceiling and wall deterioration.

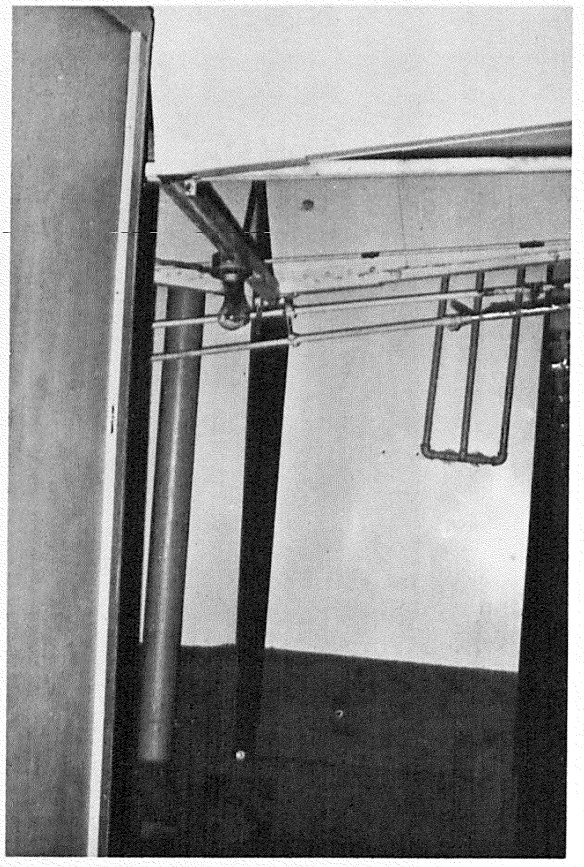

Figure 44. Roof deformation pushes shower stalls apart.

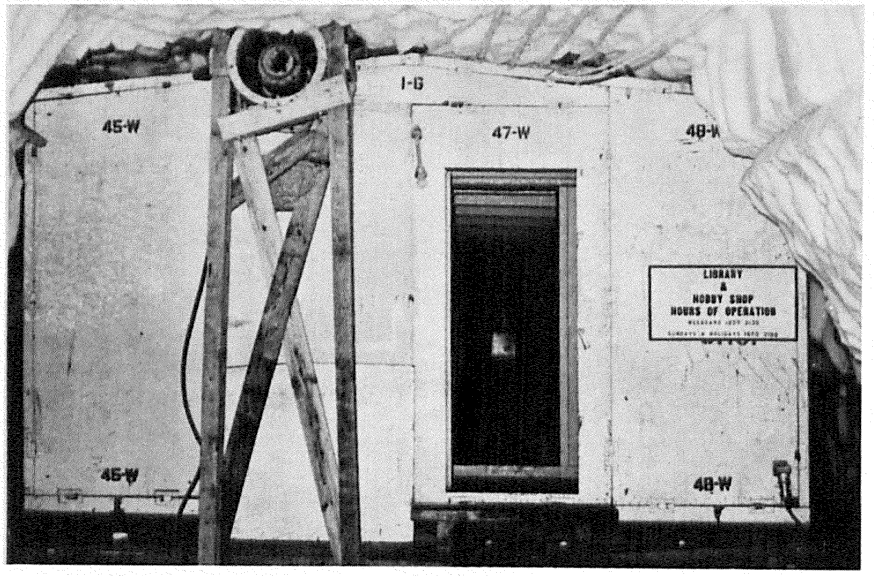

Figure 45. Snow encroaching on hobby shop and fan mounted on wooden framework.

Figure 46. Floor buckling in EM club.

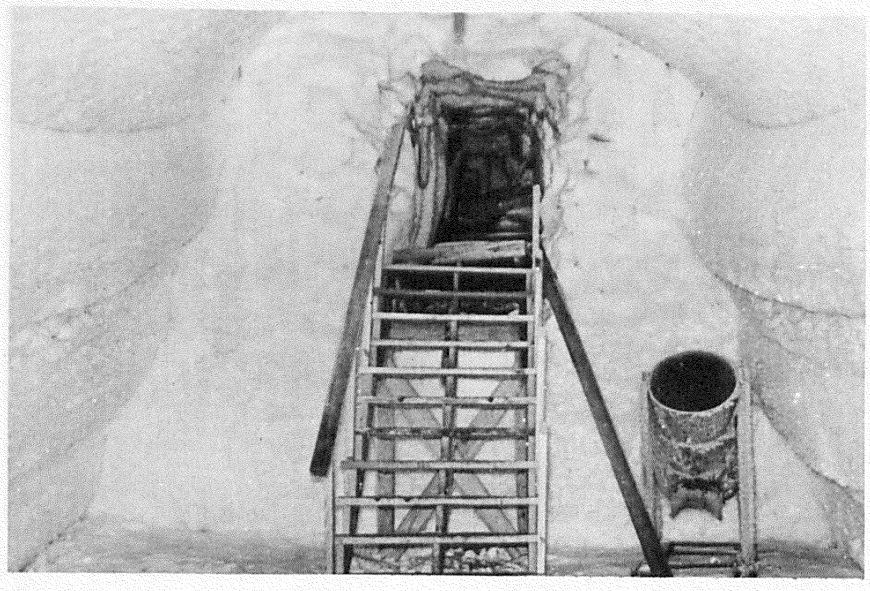

Figure 47. Stairway to escape hatch at end of Trench 9.

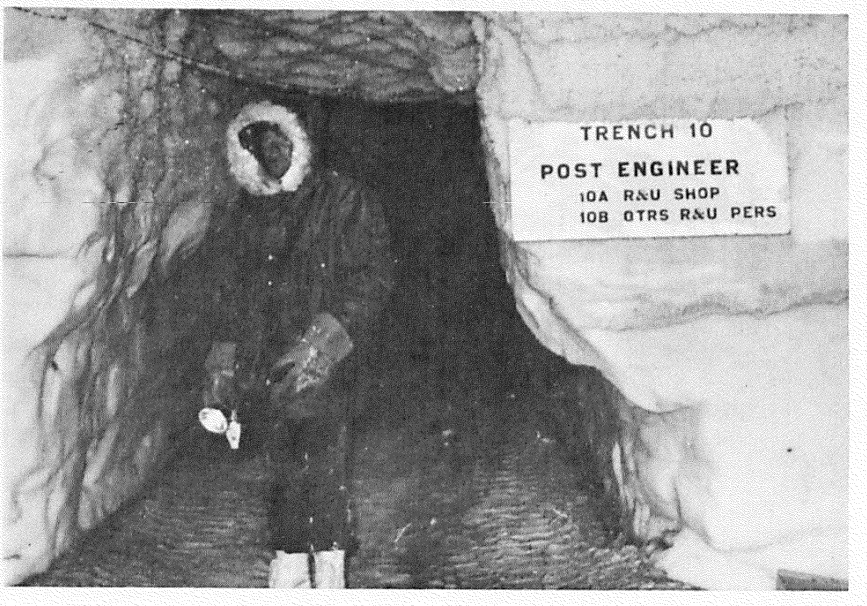

Figure 48. Entrance to Trench 10.

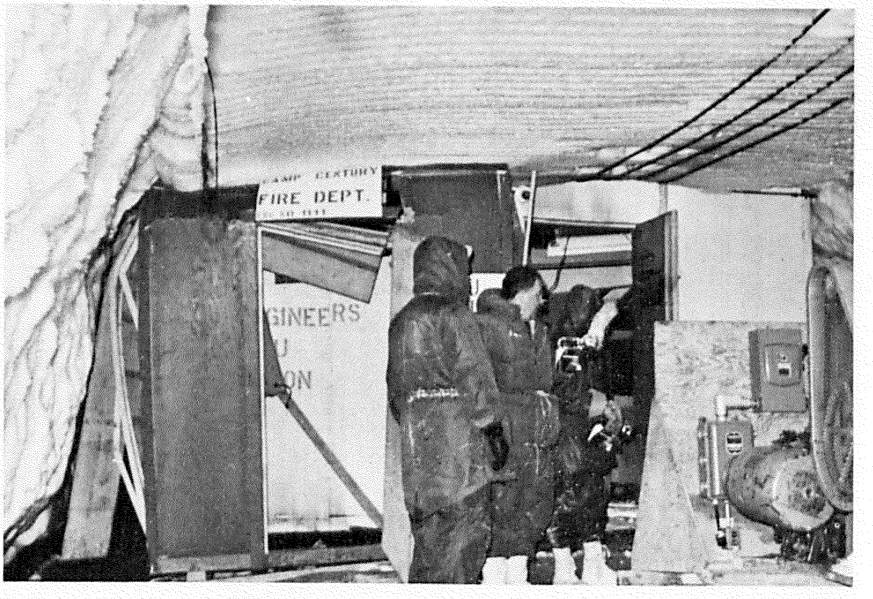

Figure 49. Front entrance to R & U shop.

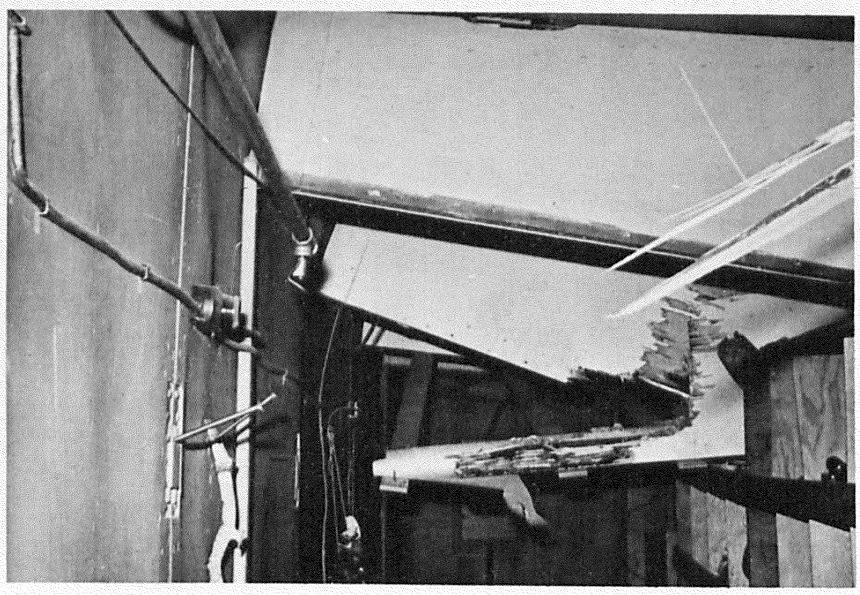

Figure 50. Split ceiling joist in R & U shop.

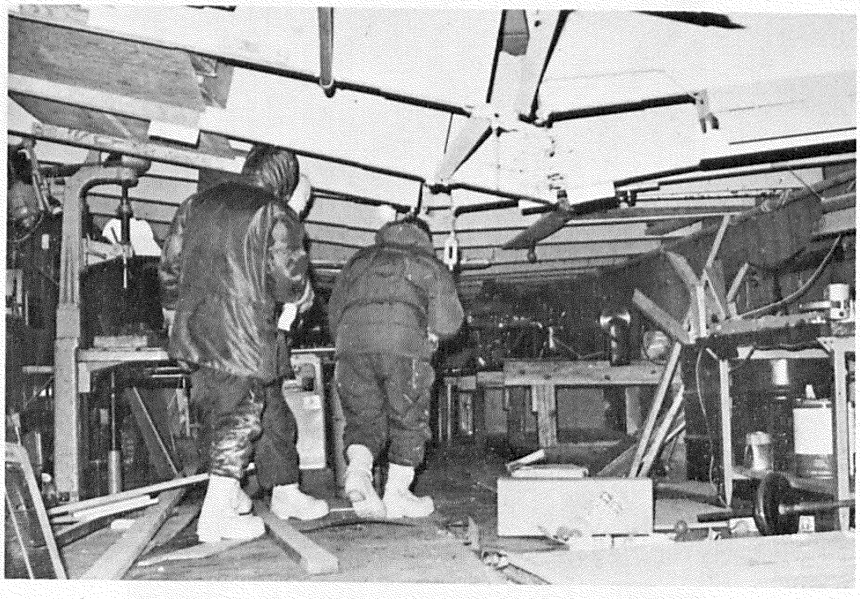

Figure 51. Interior view of R & U shop.

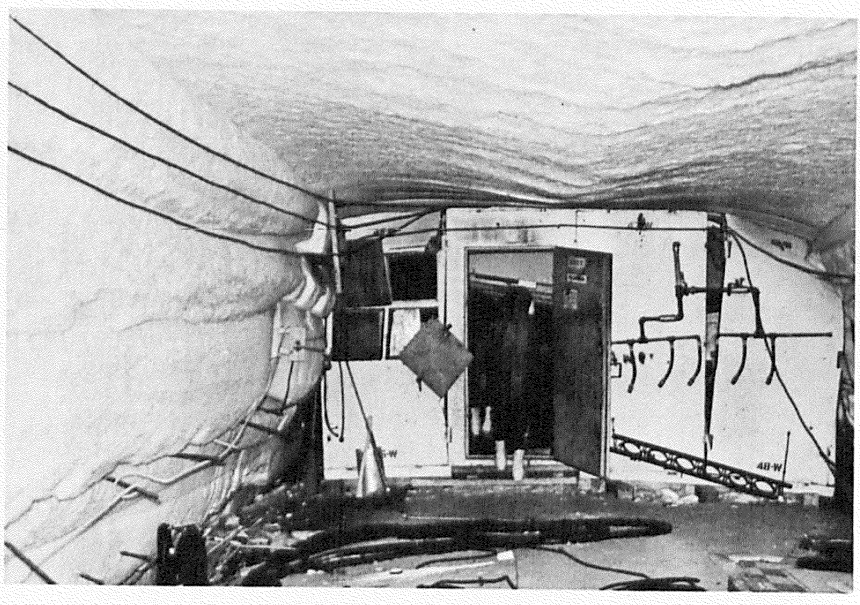

Figure 52. Back entrance to R & U shop. Note displaced wall panels.

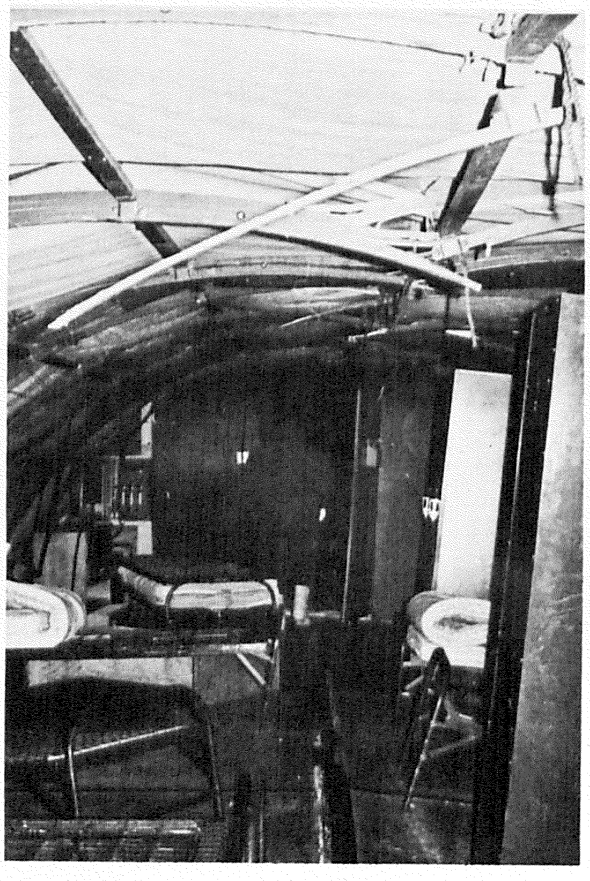

Figure 53. Interior view of Jamesway, Trench 10. Note floor panel being displaced by effect of trench floor arching.

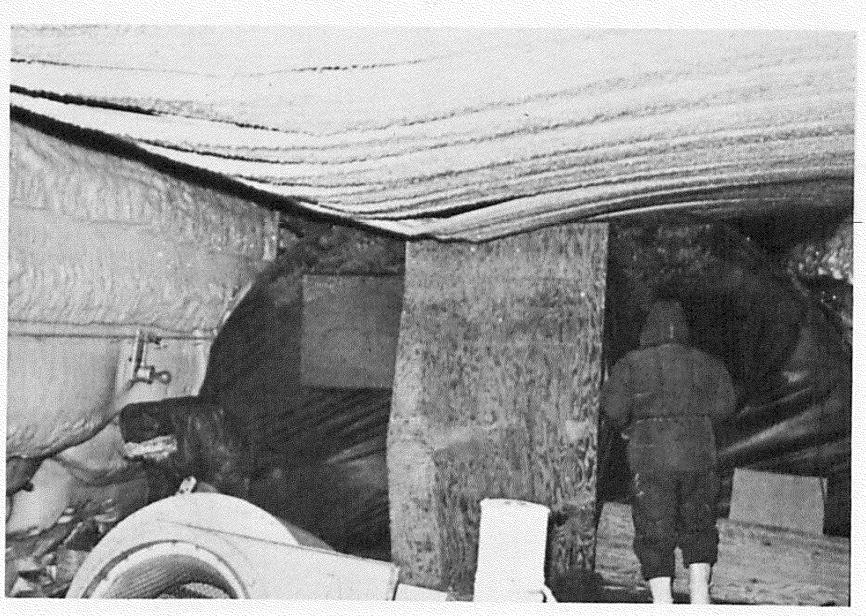

Figure 54. Metal roof arch deformation and snow encroachment upon Jamesway (Trench 10).

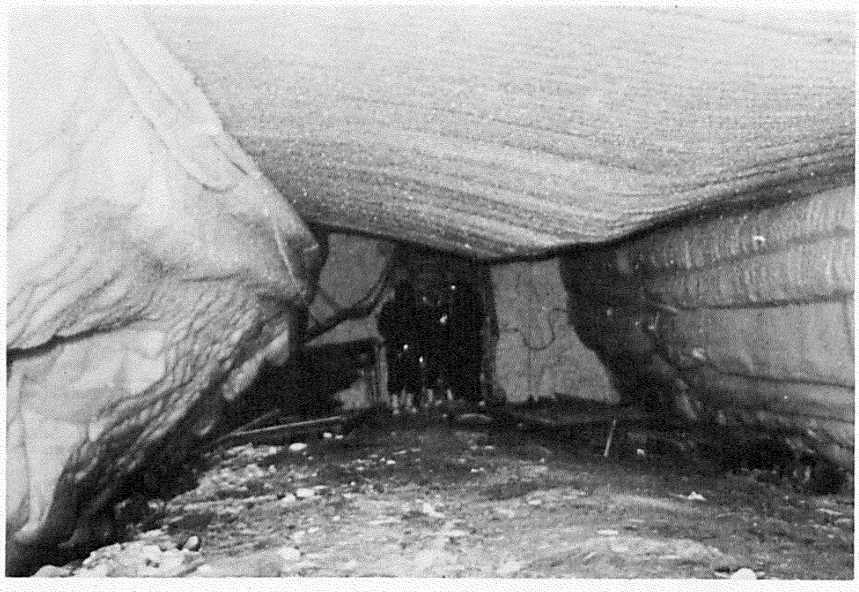

Figure 55. Stairs leading to escape hatch at rear of Trench 10.

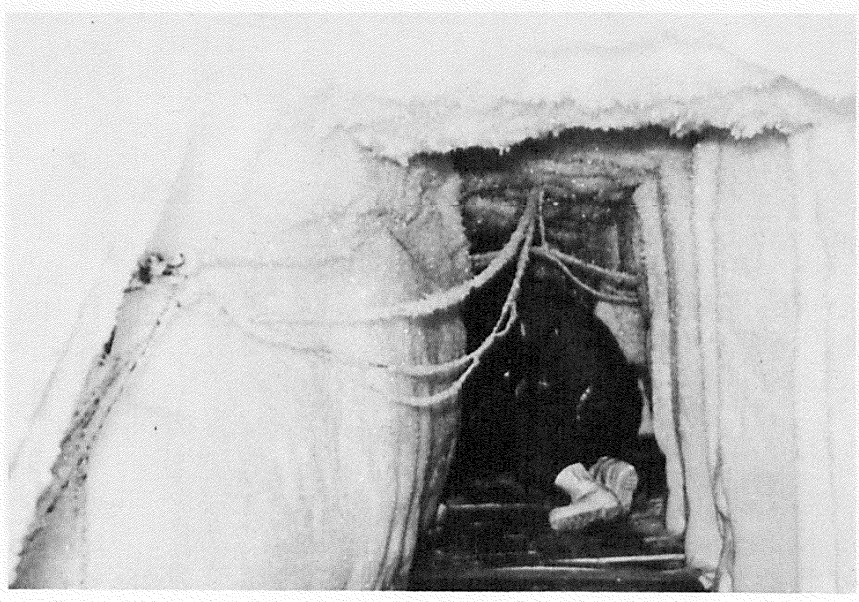

Figure 56. Narrow passageway leading to Trench 10 escape hatch.

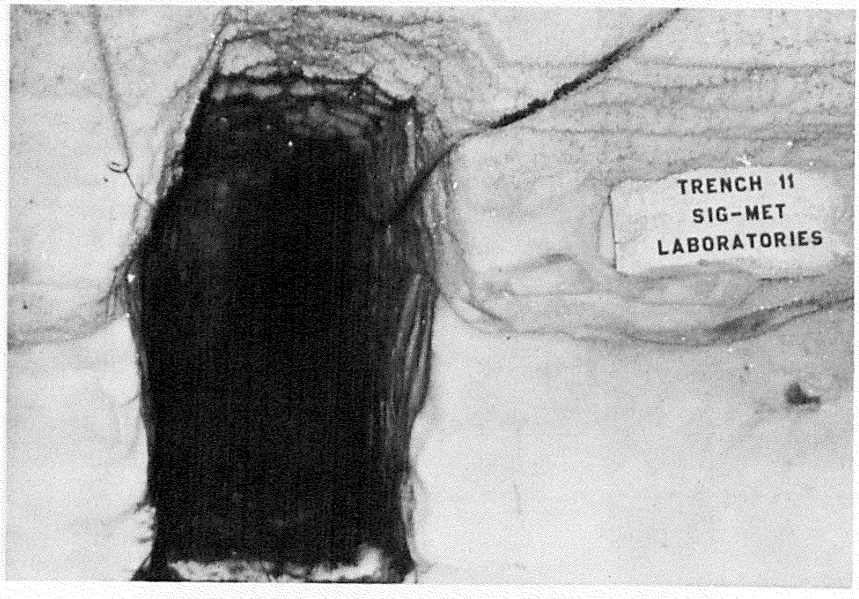

Figure 57. Entrance to Trench 11.

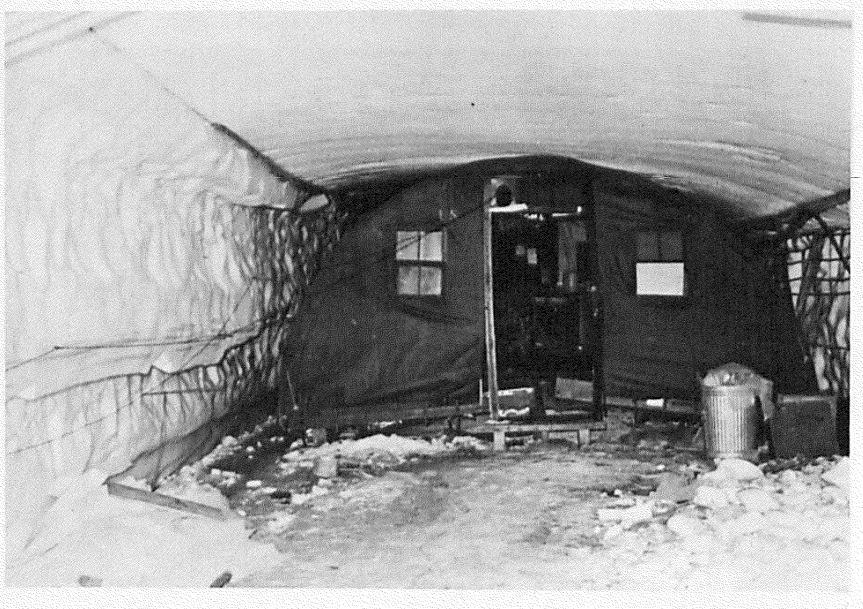

Figure 58. Jamesway Lab. Note effect of trench floor arching on Jamesway floor panels.

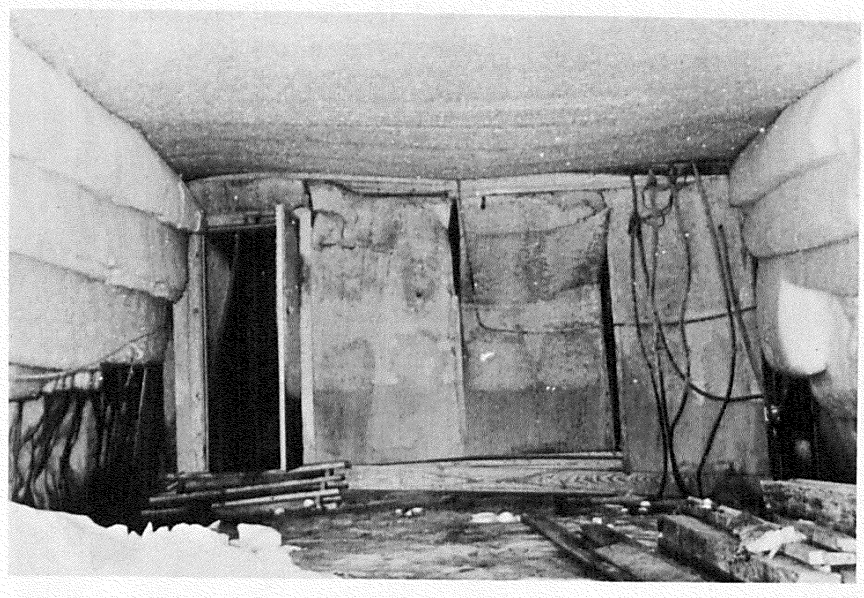

Figure 59. Overloaded wall panels of Sig. Met. building.

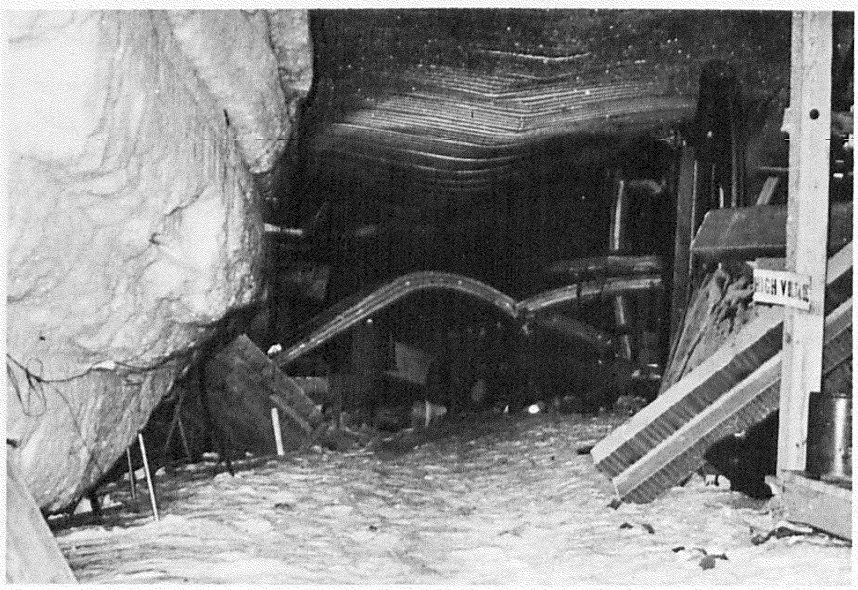

Figure 60. The floor and end wall panels of this plastic building known as the CRREL Lab were removed in 1966 to allow the removal of drilling equipment from the rear of Trench 12. The wall-roof panels later collapsed under excessive snow loading.

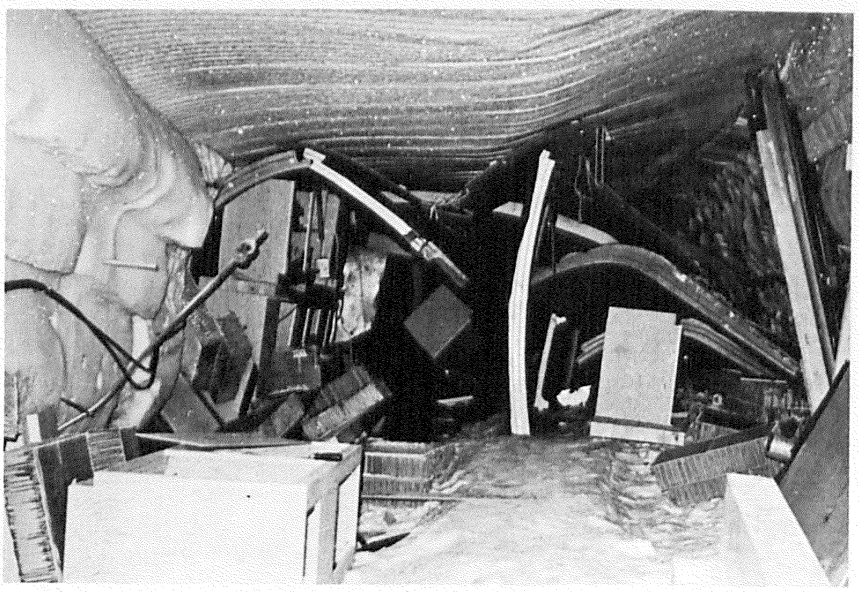

Figure 61. Rear of CRREL Lab.

Figure 62. Entrance to circular snow room, Trench 12.

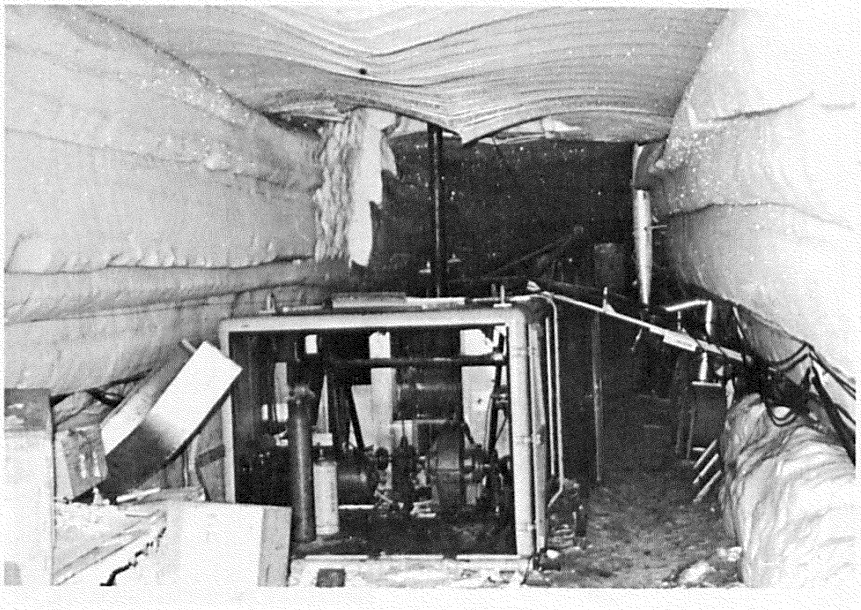

Figure 63. Partly dismantled drill rig, Trench 12.

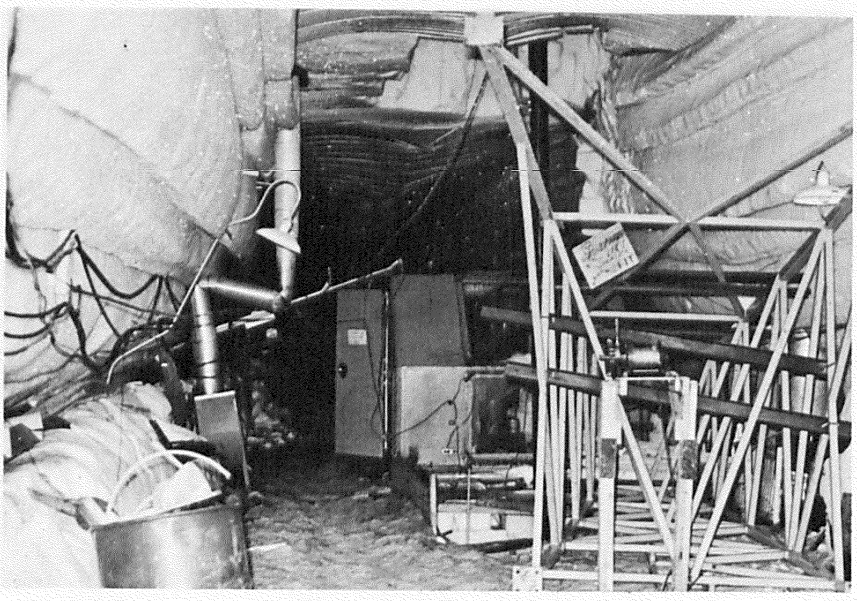

Figure 64. Drill rig and tower. Note kink in stack as a result of ceiling and snow subsidence.

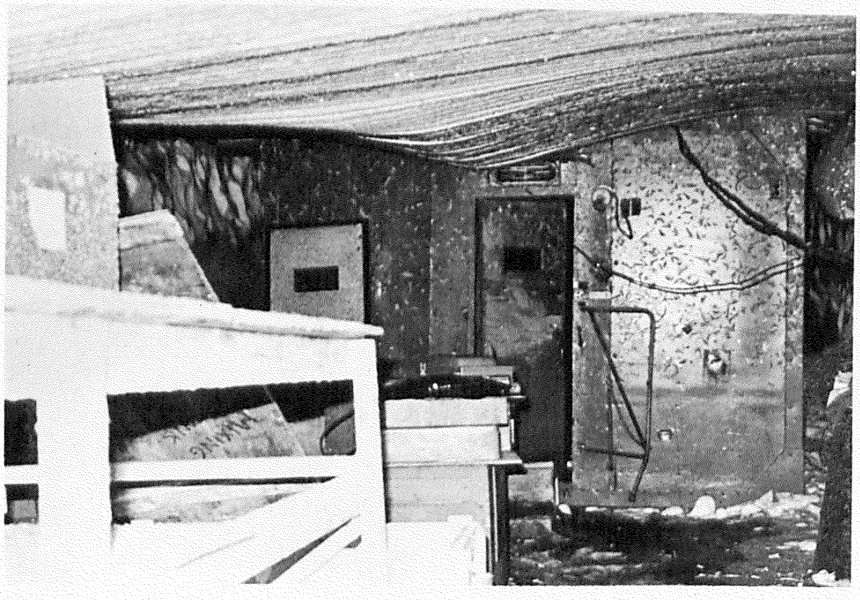

Figure 65. Work shop at rear of Trench 12.

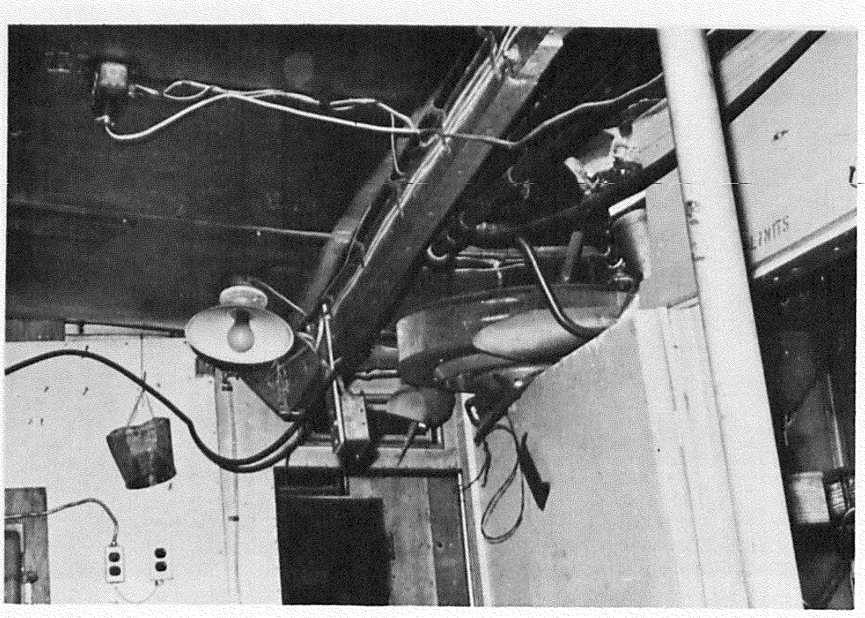

Figure 66. Snow loading of workshop ceiling has caused carrying beam to fracture and heating fan housing to be pushed into partition.

Figure 67. Entrance to standby power trench (Trench 15).

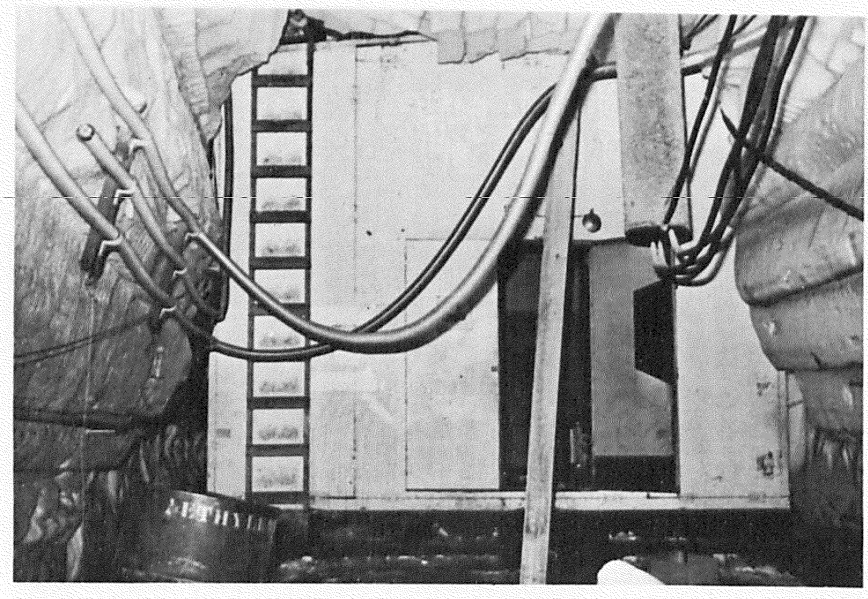

Figure 68. Snow encroaching on standby generator building.

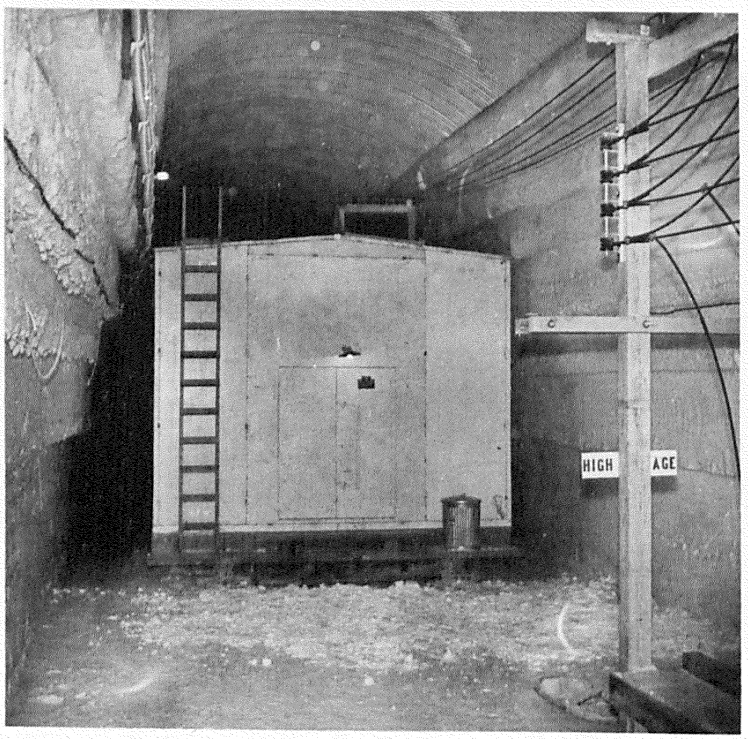

Figure 68a. Standby generator building, 1960.
(From Leighty, 1963).

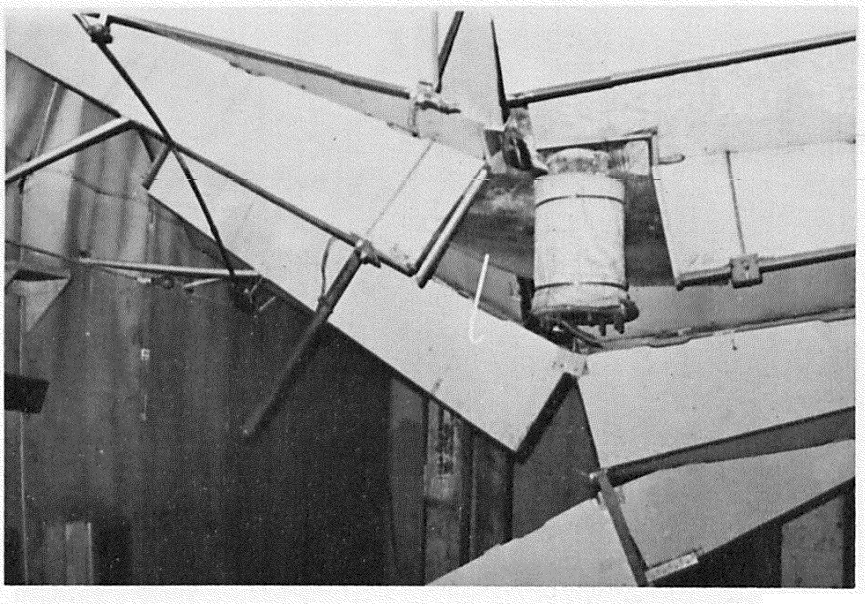

Figure 69. Effect of snow on truss ceiling Trench 15.

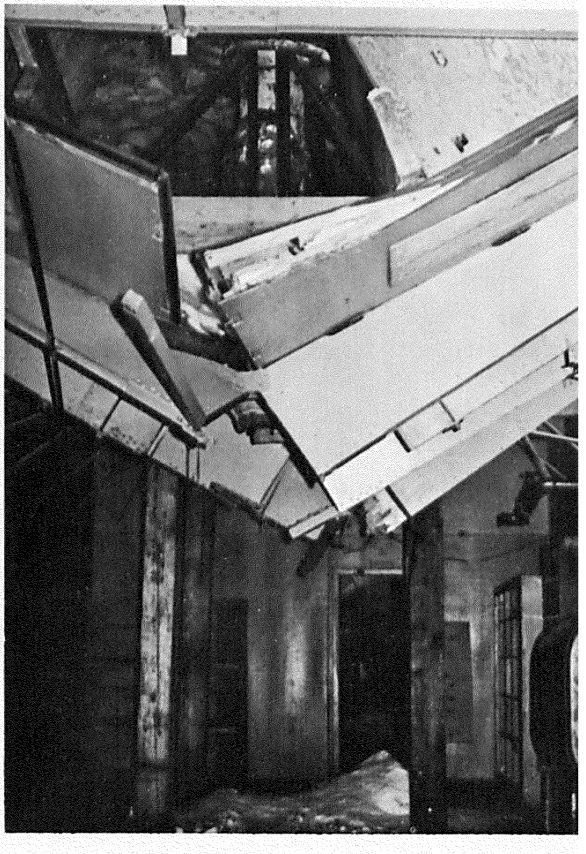

Figure 70. Ceiling cave-in at vent stack, Trench 15.

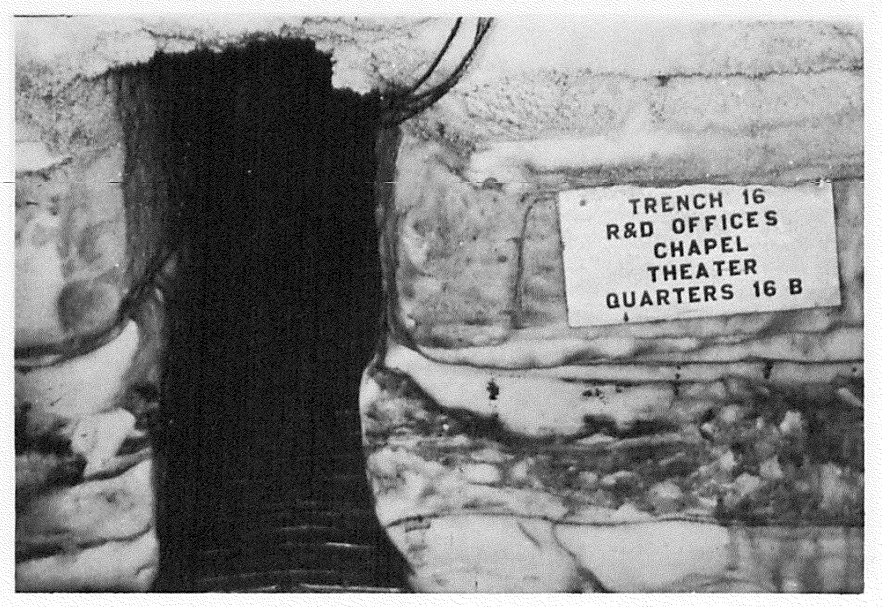

Figure 71. Trench 16 entranceway.

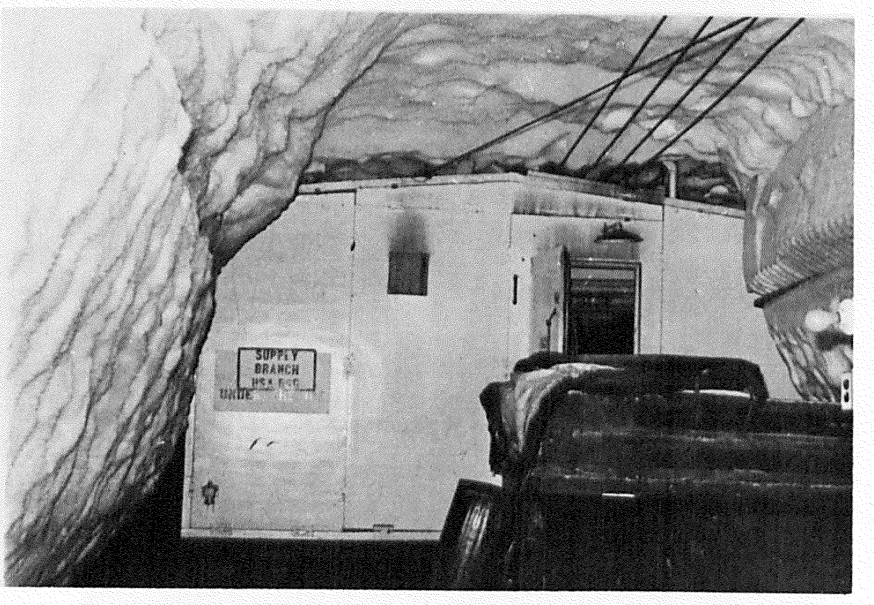

Figure 72. Snow load on roof and walls causes T-5 end wall panels to pull apart.

Figure 73. Interior of theater-chapel.

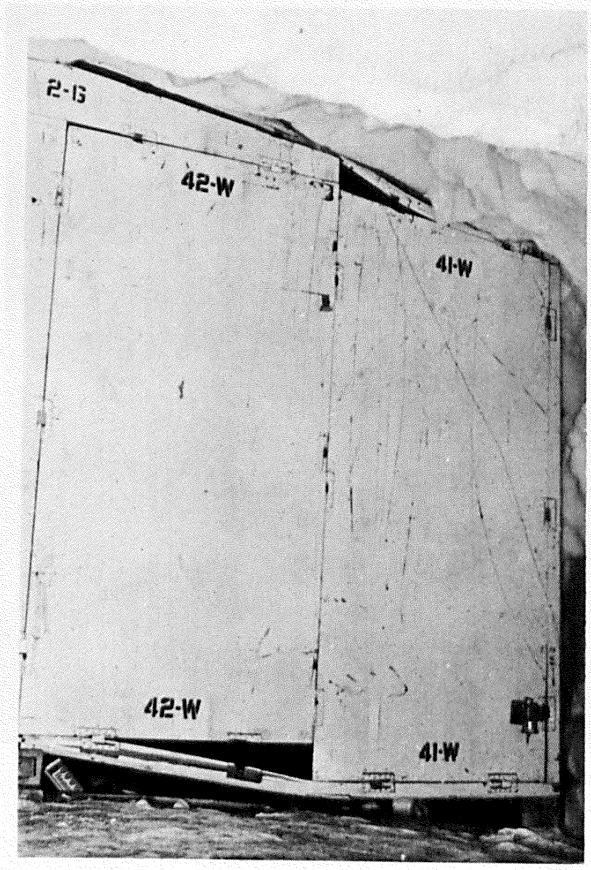

Figure 74. End wall deterioration of T-5 quarters (Trench 16).

Figure 75. Effect of snow load on Jamesway (Trench 16).

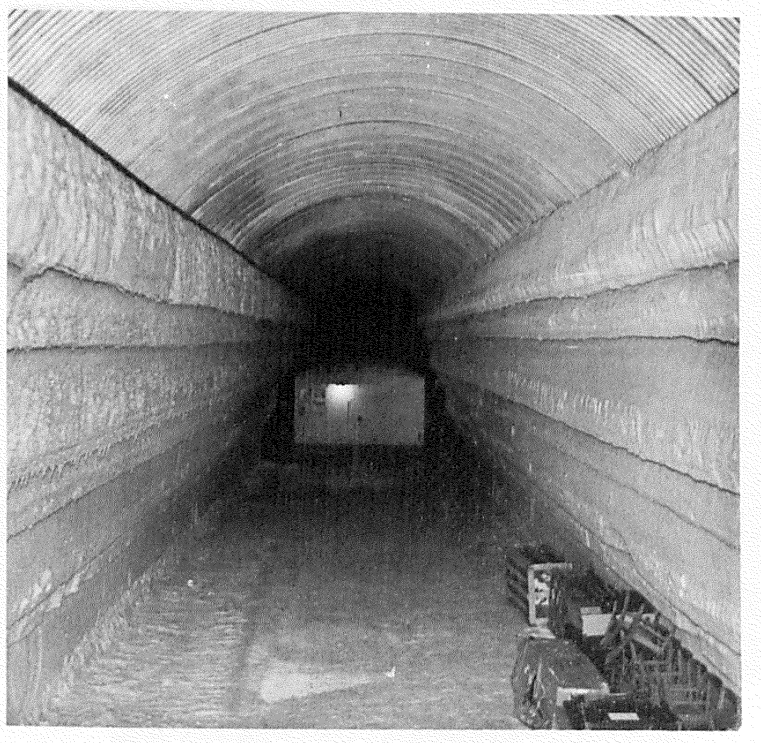

Figure 75a. A view of the same structure in 1962. (From Leighty, 1963).

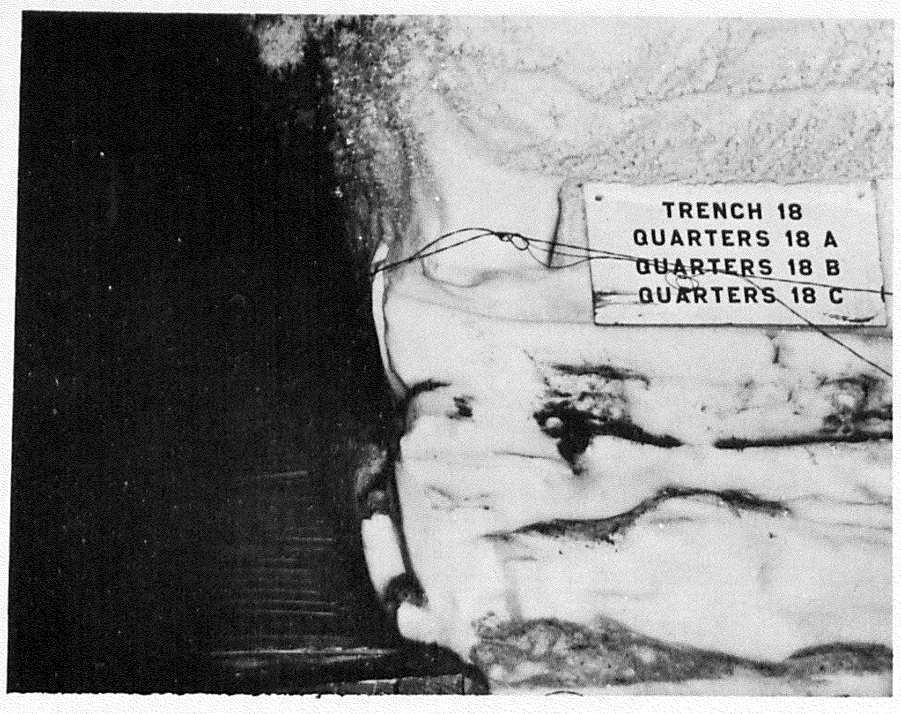

Figure 76. Trench 18 entrance.

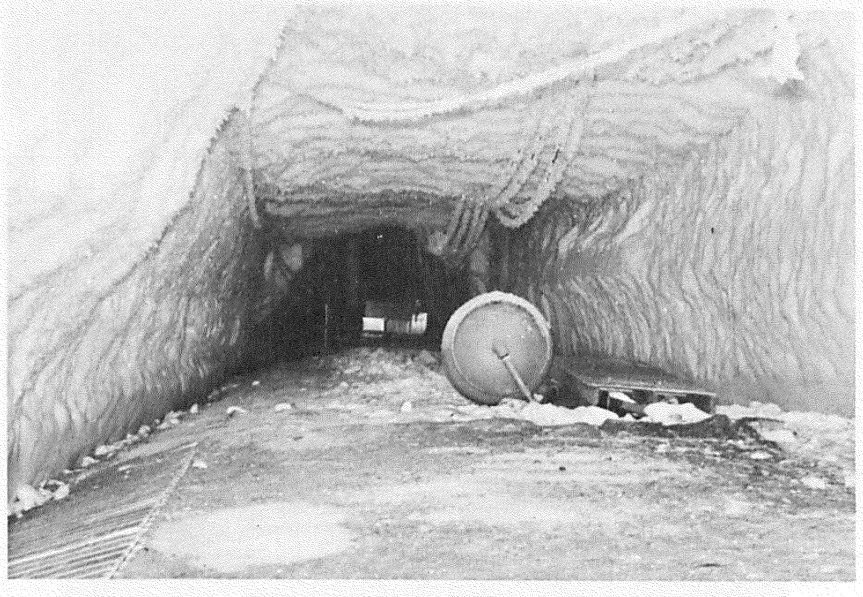

Figure 77. Interior of Trench 18. Building which once occupied this trench was removed in 1965.

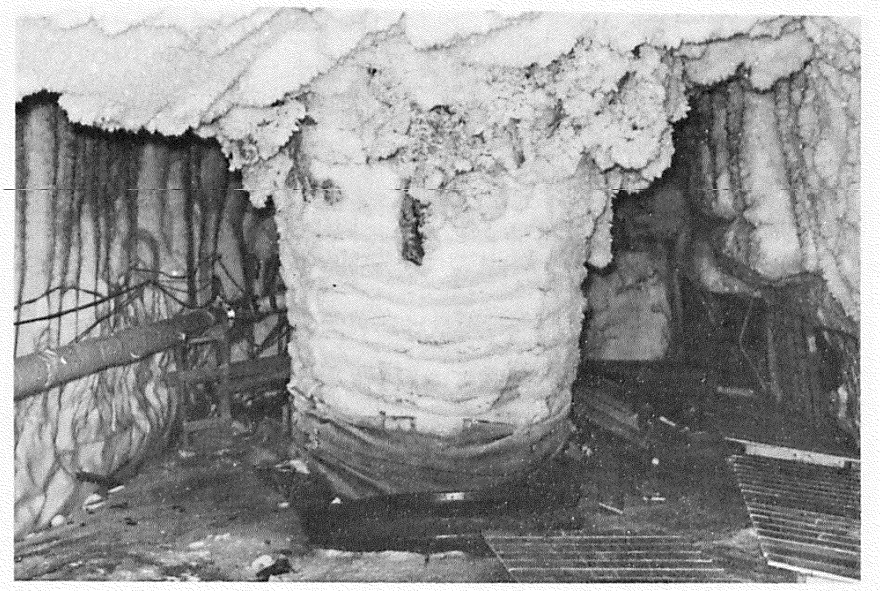

Figure 78. Crumpled escape tower (Trench 19).

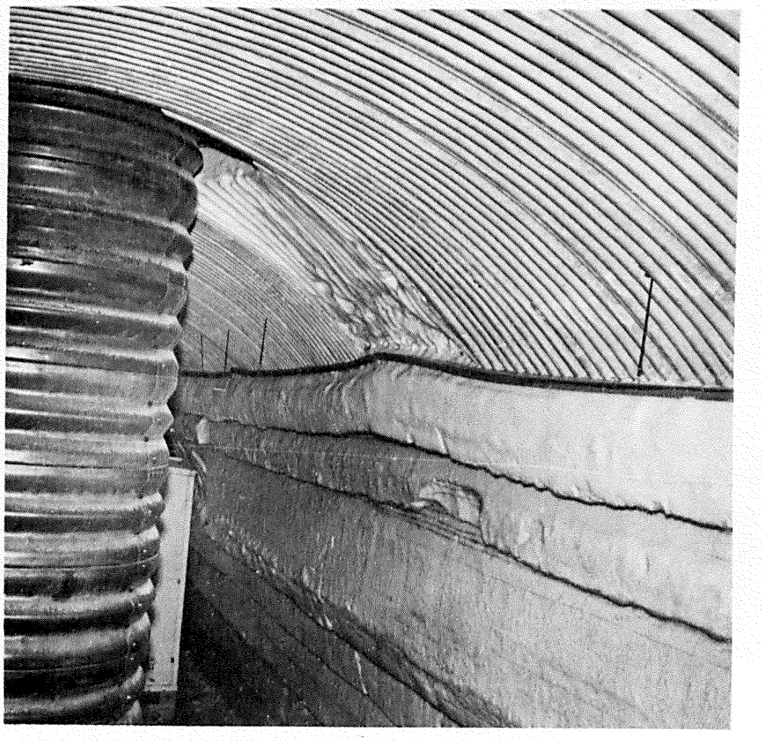

Figure 78a. The same escape tower in 1960. (From Leighty, 1963).

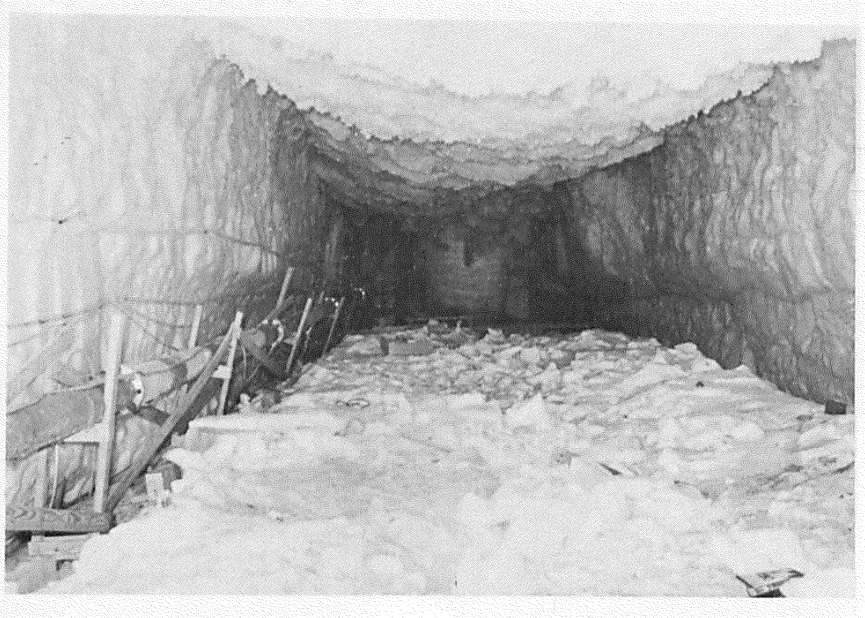

Figure 79. Interior view of Trench 19. Building which once occupied this trench was removed in 1965. Aluminum pipe along wall carried sewage to outfall pool at rear of trench.

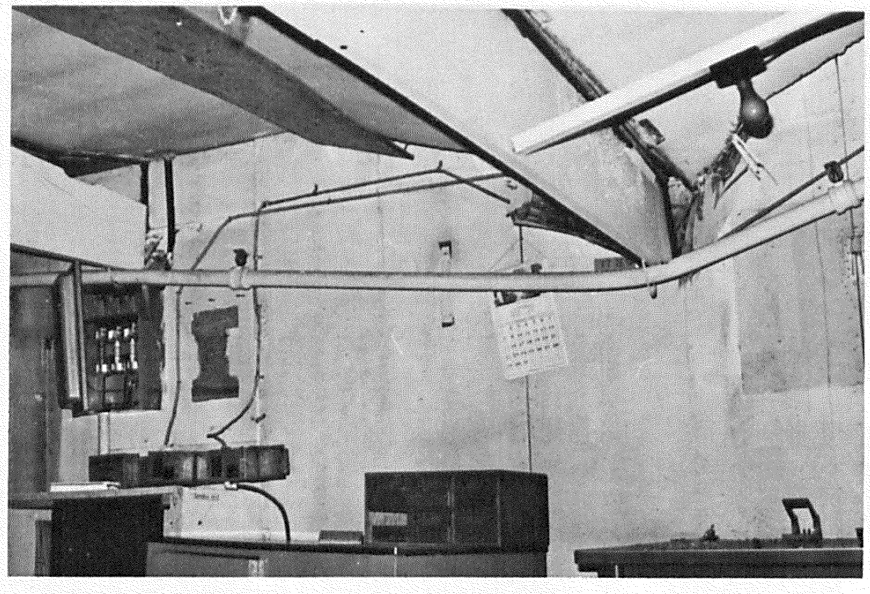

Figure 80. Sheared wall panel in headquarters building, Trench 20.

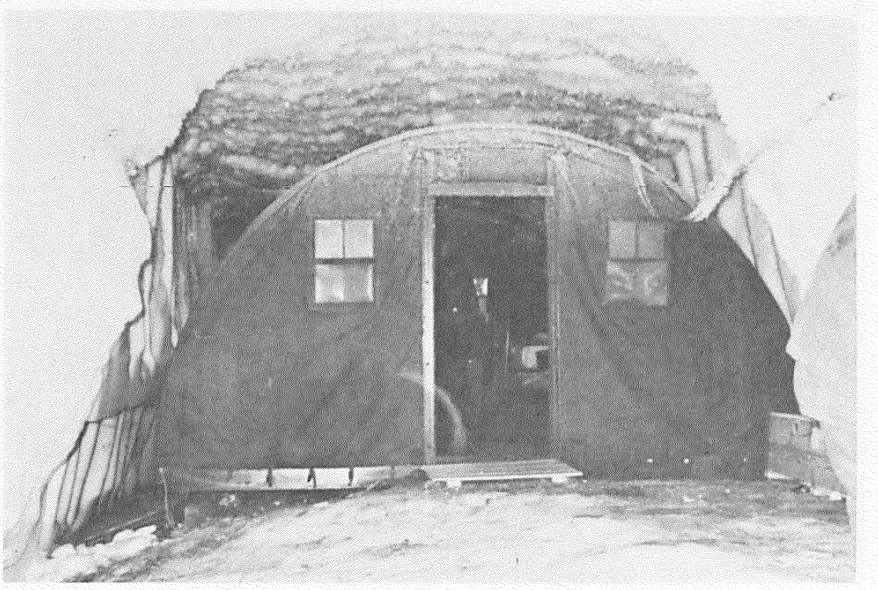

Figure 81. Jamesway at rear of Trench 20.

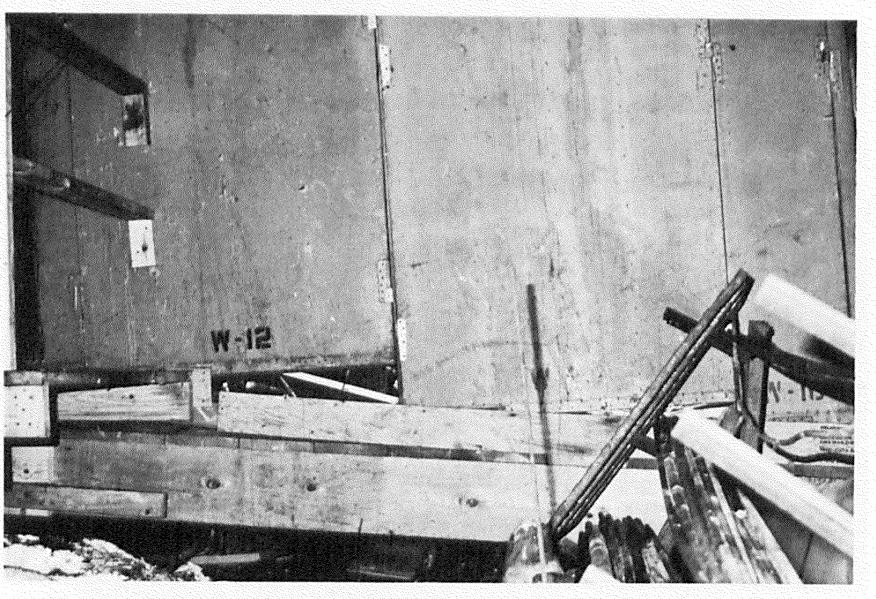

Figure 82. Displaced walls and floor at front entrance to maintenance shop, Trench 21.

Figure 83. Tearing of maintenance shop floor as a result of trench floor arching.

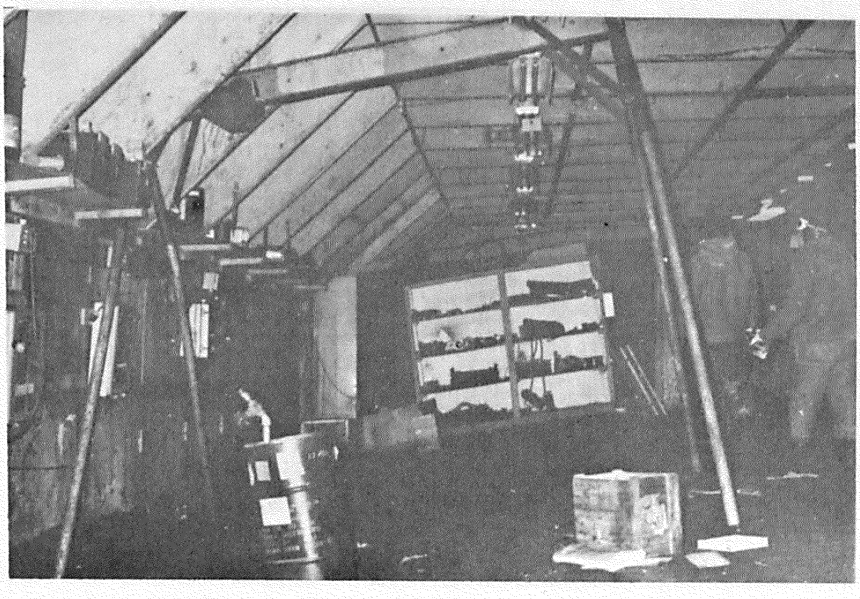

Figure 84. Floor arching in maintenance shop.

Figure 85. Steel arch deformation around maintenance shop.

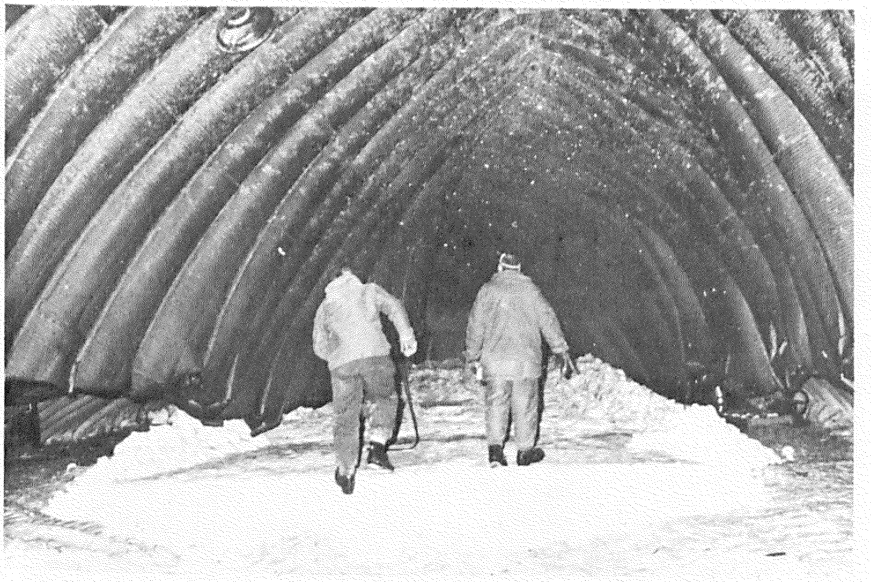

Figure 86. Arch deformation, Trench 21.

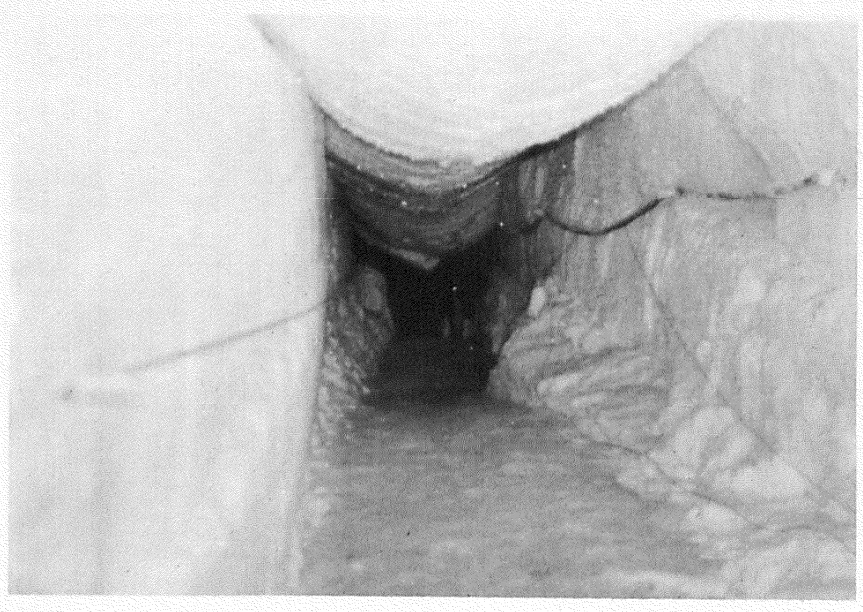

Figure 87. Passageway entering Trench 6 from railroad trench.

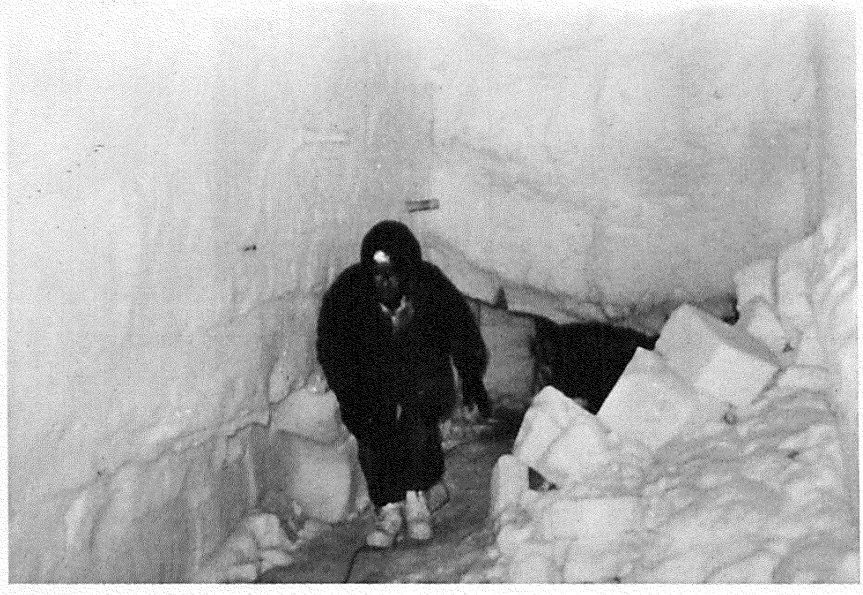

Figure 88. Entrance to railroad trench from passageway leading from Trench 6.

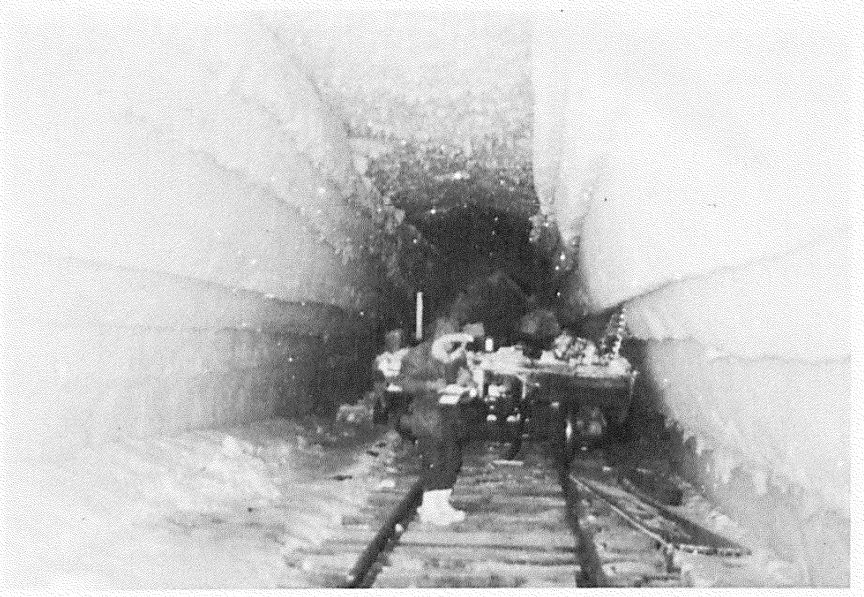

Figure 89. View of railroad trench.

Figure 90. View of railroad trench.

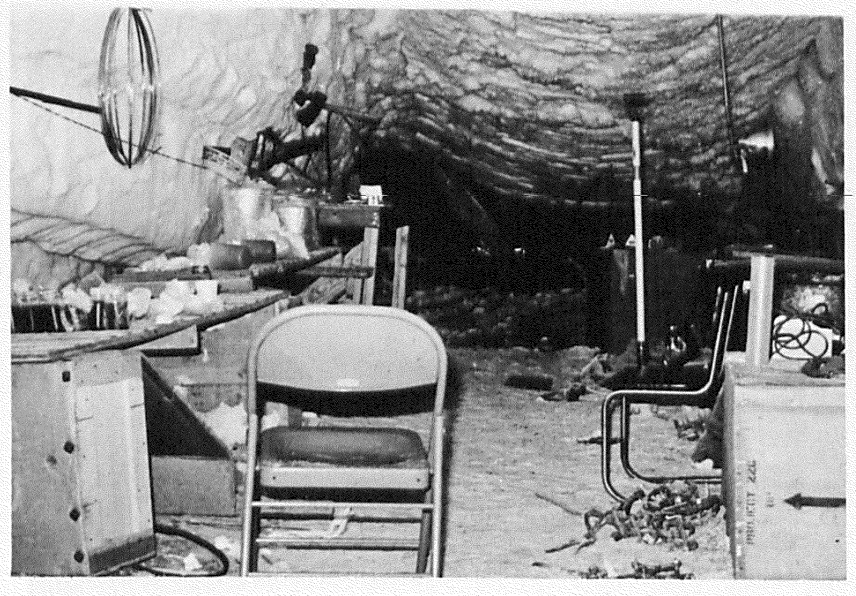

Figure 91. Roof sags most where the inclined drift and railroad trench intersect.

Figure 92. Rear of Jamesway in railroad trench.

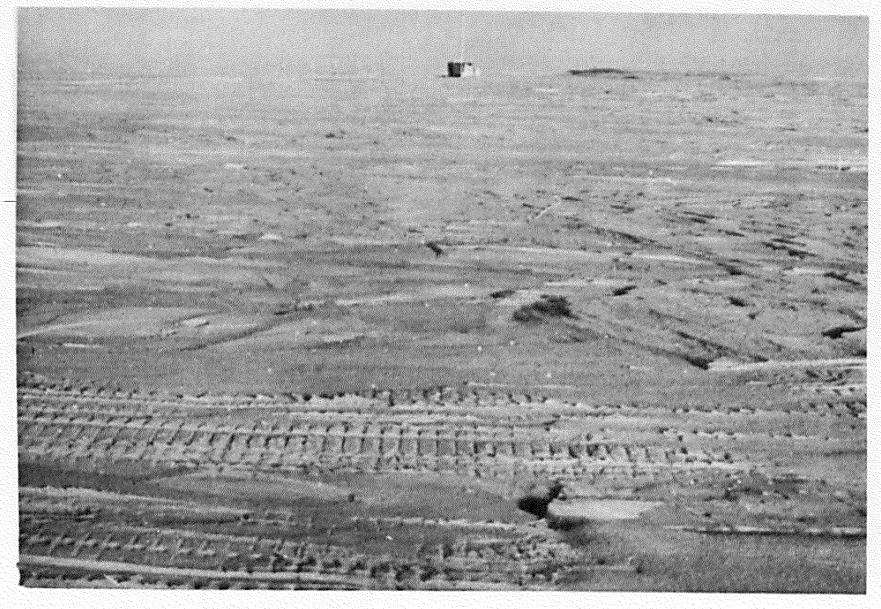

Figure 93. Escape hatch entrance to Trench 33.

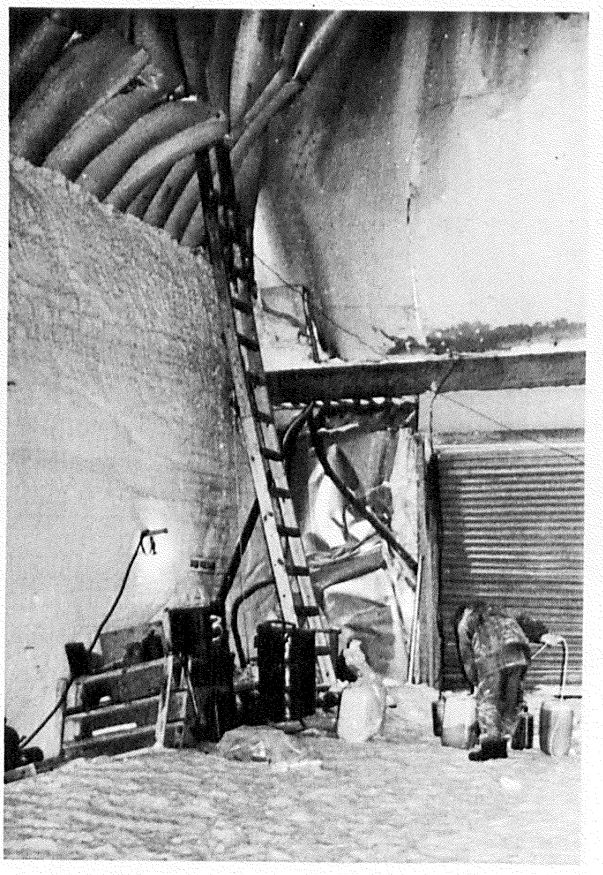

Figure 94. Effects of snow load are visible on Trench 33's deformed arch, end wall and access ladder.

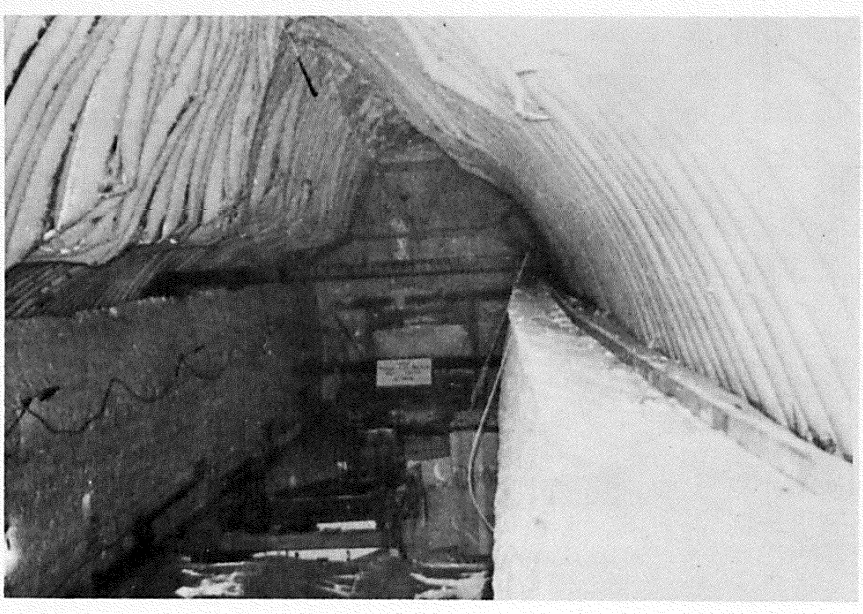

Figure 95. Looking toward north end wall of Trench 33. Note bowing and bulging of side walls.

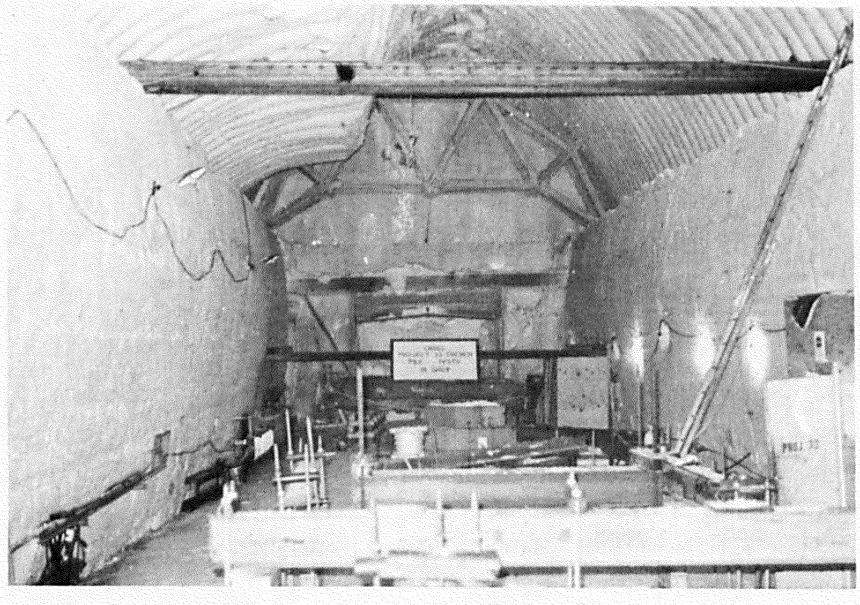

Figure 96. North end wall, Trench 33.

Figure 97. South end wall, Trench 33.

Figure 98. Departure day. C-130 lands under marginal weather conditions. It is anticipated that the roof of the building occupied by the field party will still be visible during the summer of 1970.

SELECTED BIBLIOGRAPHY

Abele, G. (1963) Trafficability in snow trenches. U.S. Army Cold Regions Research and Engineering Laboratory (USA CRREL) Technical Report 88.

Bader, H. (1953) Sorgè's law of densification of snow on high polar glaciers. U.S. Army Snow, Ice and Permafrost Research Establishment (USA SIPRE) Research Paper 2.

_____ (1960) Theory of densification of dry snow on high polar glaciers. USA SIPRE Research Report 69.

Barnett, James W., Major CE (1961) Construction of the Army nuclear power plant, PM-2A, at Camp Century, Greenland (final report). Department of the Army, Office of the Chief of Engineers, Nuclear Power Division.

Clark, E.F. (1965) Camp Century. Evolution of concept and history of design, construction and performance. USA CRREL Technical Report 174.

Evans, T.C., Major CE (1960) The construction of Camp Century (final report). U.S. Army Polar Research and Development Center.

Kovacs, A. (1967) Density, temperature and the unconfined compressive strength of polar snow. USA CRREL Special Report 115.

_____ (1968) Trench floor arching study. In *Feasibility study of pile foundations in polar snow.* USA CRREL Technical Report (unpublished).

Landauer, J.K. (1957) On deformation of excavations in the Greenland névé. USA SIPRE Research Report 30.

Leighty, Robert D. (1963) Pictorial performance study of Camp Century, 1960-1962. USA CRREL Special Report 56.

Mellor, Malcolm (1964) Properties of snow. USA CRREL Monograph III-A1.

Nakaya, Ukichiro (1959) Visco-elastic properties of processed snow. USA SIPRE Research Report 58.

Tobiasson, W. and Rissling, D.L. (1966) A straight-wall cut-and-cover snow trench. USA CRREL Technical Report 151.

Waterhouse, R.W. (1955) Structures for snow investigations on the Greenland Ice Cap. USA SIPRE Technical Report 27.

_____ (1960) Snow densification theory and its engineering application. USA SIPRE Technical Report 71.

_____ (1960) Cut-and-cover trenching in snow. USA SIPRE Technical Report 76.

_____; Tobiasson, W.N.; and Scott, B.G. (1963) Camp Century movement record. USA CRREL Technical Report 121.

Yen, Yin-Chao and Bender, J.A. (1962) Cooling of an undersnow camp. USA CRREL Research Report 95.

Unclassified

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)	2a. REPORT SECURITY CLASSIFICATION
U.S. Army Cold Regions Research and Engineering Laboratory Hanover, N.H. 03755	Unclassified
	2b. GROUP

3. REPORT TITLE

CAMP CENTURY REVISITED - A PICTORIAL VIEW - JUNE 1969

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

5. AUTHOR(S) (First name, middle initial, last name)

Austin Kovacs

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
July 1970	57	18

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
b. PROJECT NO. DA Task 1T062112A13001	Special Report 150
c.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
d.	

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11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
	U.S. Army Cold Regions Research and Engineering Laboratory Hanover, N.H. 03755

13. ABSTRACT

Camp Century, Greenland, constructed in 1959 and abandoned in 1966, was revisited 22 May and 2 June 1969. Ninety-six photographs show local surface features and conditions existing within the buried camp complex. The effects of trench closure are dramatically shown.

14. KEYWORDS

Arctic regions
Camp Century
Cold weather construction
Greenland Ice Cap

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