

# Igloo

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An **igloo** (Inuit language: *iglu*,<sup>[1]</sup> Inuktitut syllabics ᐃᓄ [iɣˈlu] (plural: *igluit* ᐃᓄᐃᑦ [iɣluˈit]), also known as a **snow house** or **snow hut**, is a type of shelter built of snow, typically built when the snow can be easily compacted.

Although igloos are stereotypically associated with all Inuit,<sup>[2]</sup> they were traditionally associated with people of Canada's Central Arctic and Greenland's Thule area. Other Inuit people tended to use snow to insulate their houses, which were constructed from whalebone and hides. Snow is used because the air pockets trapped in it make it an insulator. On the outside, temperatures may be as low as −45 °C (−49 °F), but on the inside the temperature may range from −7 °C (19 °F) to 16 °C (61 °F) when warmed by body heat alone.<sup>[3]</sup>

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Community of igloos (Illustration from Charles Francis Hall's *Arctic Researches and Life Among the Esquimaux*, 1865)



An Inuk inside of an igloo (upper-right corner of image), circa 1900–1923. Photograph by Canadian Geological Survey.

## Nomenclature

The Inuit language word *iglu* (plural *igluit*) can be used for a house or home built of any material,<sup>[1]</sup> and is not restricted exclusively to snowhouses (called specifically *igluvijaq*, plural *igluvijait*), but includes traditional tents, sod houses, homes constructed of driftwood and modern buildings.<sup>[4][5]</sup> Several dialects throughout the Canadian Arctic (Siglitun, Inuinnaqtun, Natsilingmiutut, Kivalliq, North Baffin) use *iglu* for all buildings, including snowhouses, and it is the term used by the Government of Nunavut.<sup>[1][6][7]</sup> An exception to this is the dialect used in the Igloodik region. *Iglu* is used for other buildings, while *igluvijaq*,<sup>[8]</sup> (plural *igluvijait*, Inuktitut syllabics: ᐃᓄᐃᑦᐃᑦᐅᑦ) is specifically used for a snowhouse. Outside Inuit culture, however, *igloo* refers exclusively to shelters constructed from blocks of compacted snow, generally in the form of a dome.

## Types

There are three traditional types of igloos, all of different sizes and used for different purposes.<sup>[9]</sup>

- The smallest were constructed as temporary shelters, usually only used for one or two nights. These were built and used during hunting trips, often on open sea ice.
- Intermediate-sized igloos were for semi-permanent, family dwelling. This was usually a single room dwelling that housed one or two families. Often there were several of these in a small area, which formed an Inuit village.
- The largest igloos were normally built in groups of two. One of the buildings was a temporary structure built for special occasions, the other built nearby for living. These might have had up to five rooms and housed up to 20 people. A large igloo might have been constructed from several smaller igloos attached by their tunnels, giving common access to the outside. These were used to hold community feasts and traditional dances.



Inuit building an igloo

## Engineering

Snow igloos are built in the shape of a catenoid, which offers optimal ratios between the height and diameter of the structure to eliminate the structural tension which could otherwise cause it to implode or bulge. The stresses of snow as it ages and compresses against the igloo will not cause it to buckle because in an inverted paraboloid or catenoid the pressures are exclusively compressive.<sup>[10]</sup>

This design originates from the Central Inuit.<sup>[10]</sup> In applied mechanics, the equation for this type of structure is written  $y = a(\cosh x/a - 1)$  where  $y$  is the height to any point in the surface,  $x$  is the horizontal distance to the same point, and  $a$  is a constant.<sup>[10]</sup>

If the walls are of uniform thickness and density, the maximum compressive stress at the base of a paraboloid

$$\text{is } S_{\alpha} = \frac{\gamma d^2}{24h} \cdot \frac{1 + \cos \alpha + \cos^2 \alpha}{(1 + \cos \alpha) \cos^2 \alpha}$$

where  $d$  is the diameter at the base,  $h$  is the height,  $\gamma$  is the unit weight of the snow, and  $\alpha = \arctan(4h/d)$ .<sup>[11]</sup>

Since stress is a force per unit area, if the walls are of uniform thickness the compressive stress is independent of wall thickness; thicker walls provide better insulation but do not strengthen the structure because of added weight.<sup>[12]</sup>

The maximum compressive stress at the base of the igloo can be obtained by multiplying  $S_{\alpha}/\gamma d$  times the snow unit weight  $\gamma$  and the mean igloo base diameter.

Igloos gradually become shorter with time due to the compressive creep of the snow.<sup>[10]</sup>

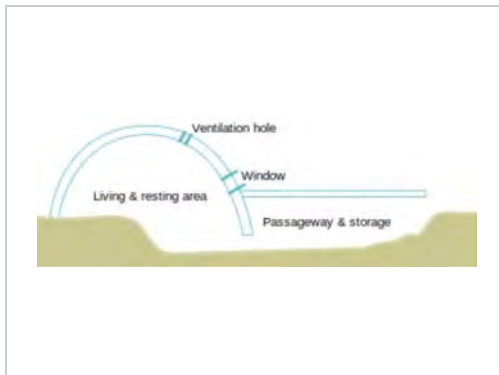
## Construction

The snow used to build an igloo must have enough structural strength to be cut and stacked appropriately. The best snow to use for this purpose is snow which has been blown by wind, which can serve to compact and interlock the ice crystals. The hole left in the snow where the blocks are cut is usually used as the lower half of the shelter. Sometimes, a short tunnel is constructed at the entrance to reduce wind and heat loss when the door

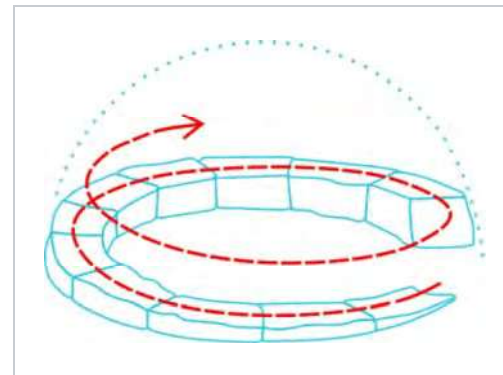
is opened. Snow's effective insulating properties enable the inside of the igloo to remain relatively warm. In some cases, a single block of clear ice is inserted to allow light into the igloo. Animal skins were used as door flaps to keep warm air in. Igloos used as winter shelters had beds made of ice and caribou furs. These 'ice beds' are unique to the region and Inuit culture.

Architecturally, the igloo is unique in that it is a dome that can be raised out of independent blocks leaning on each other and polished to fit without an additional supporting structure during construction. An igloo that is built correctly will support the weight of a person standing on the roof. In the traditional Inuit igloo the heat from the *kudlik* (*qulliq*, stone lamp) causes the interior to melt slightly. This melting and refreezing builds up a layer of ice that contributes to the strength of the igloo.<sup>[13]</sup>

### Igloo construction



An igloo side view diagram; opening to the right, the optional window may be composed of an ice block

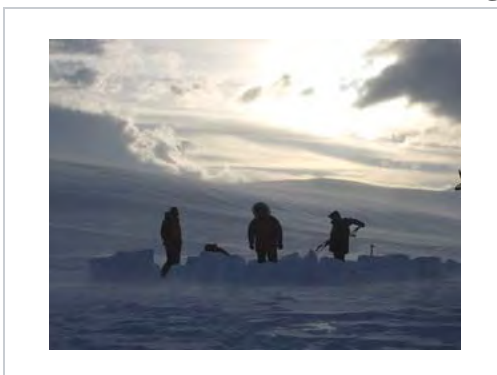


An igloo's snowbrick laying method

The sleeping platform is a raised area. Because warmer air rises and cooler air settles, the entrance area acts as a cold trap whereas the sleeping area will hold whatever heat is generated by a stove, lamp, body heat, or other device.

The Central Inuit, especially those around the Davis Strait, lined the living area with skin, which could increase the temperature within from around 2 °C (36 °F) to 10–20 °C (50–68 °F).

### Igloos



Process of building an igloo with snowbrick method in mid-way



A nearly complete, medium-sized igloo, with excavation under the door and the exterior unfinished



Interior of an igloo, facing the passageway leading to the entrance

## See also

- Glacier cave – a natural hollow space within a glacier
- Quinzhee – a shelter made by hollowing out a pile of settled snow
- Snow cave – a shelter constructed in snow
- Snow fort – a usually open-topped temporary structure made of snow walls that is usually used for recreational purposes
- Vernacular architecture – a category of architecture based on local needs, construction materials and reflecting local traditions

## References

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## Further reading

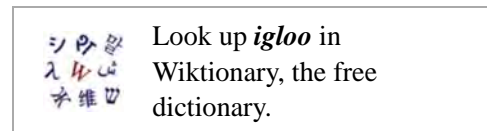
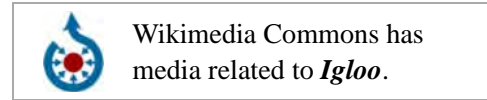
- Richard Gv. Condon, Julia Ogina and the Holman Elders, *The Northern Copper Inuit* (ISBN

0-8020-0849-6)

- Igloo – the Traditional Arctic Snow Dome (<http://www.kstrom.net/isk/maps/houses/igloo.html>)
- An article on igloos from *The Canadian Encyclopedia* (<http://www.thecanadianencyclopedia.com/en/article/igloo/>)
- Watch *How to Build an Igloo* ([http://www.nfb.ca/film/How\\_to\\_Build\\_an\\_Igloo](http://www.nfb.ca/film/How_to_Build_an_Igloo)) (National Film Board of Canada)
- *Field Manual for the U.S. Antarctic Program*, Chapter 11: "Snow Shelters", pp. 140-145 (<http://www.usap.gov/travelAndDeployment/documents/FieldManual-Chapt11SnowShelters.pdf>)
- Traditional Dwellings: Igloos (1) ([http://epe.lac-bac.gc.ca/100/205/301/ic/cdc/cape\\_dorset/dwell1.html](http://epe.lac-bac.gc.ca/100/205/301/ic/cdc/cape_dorset/dwell1.html)) (Interview; Library and Archives Canada)

## External links

- Building an Igloo, by Hugh McManners (<http://www.benmeadows.com/refinfo/Tips/Article1.htm>)
- How to Build an Igloo (wikiHow)



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