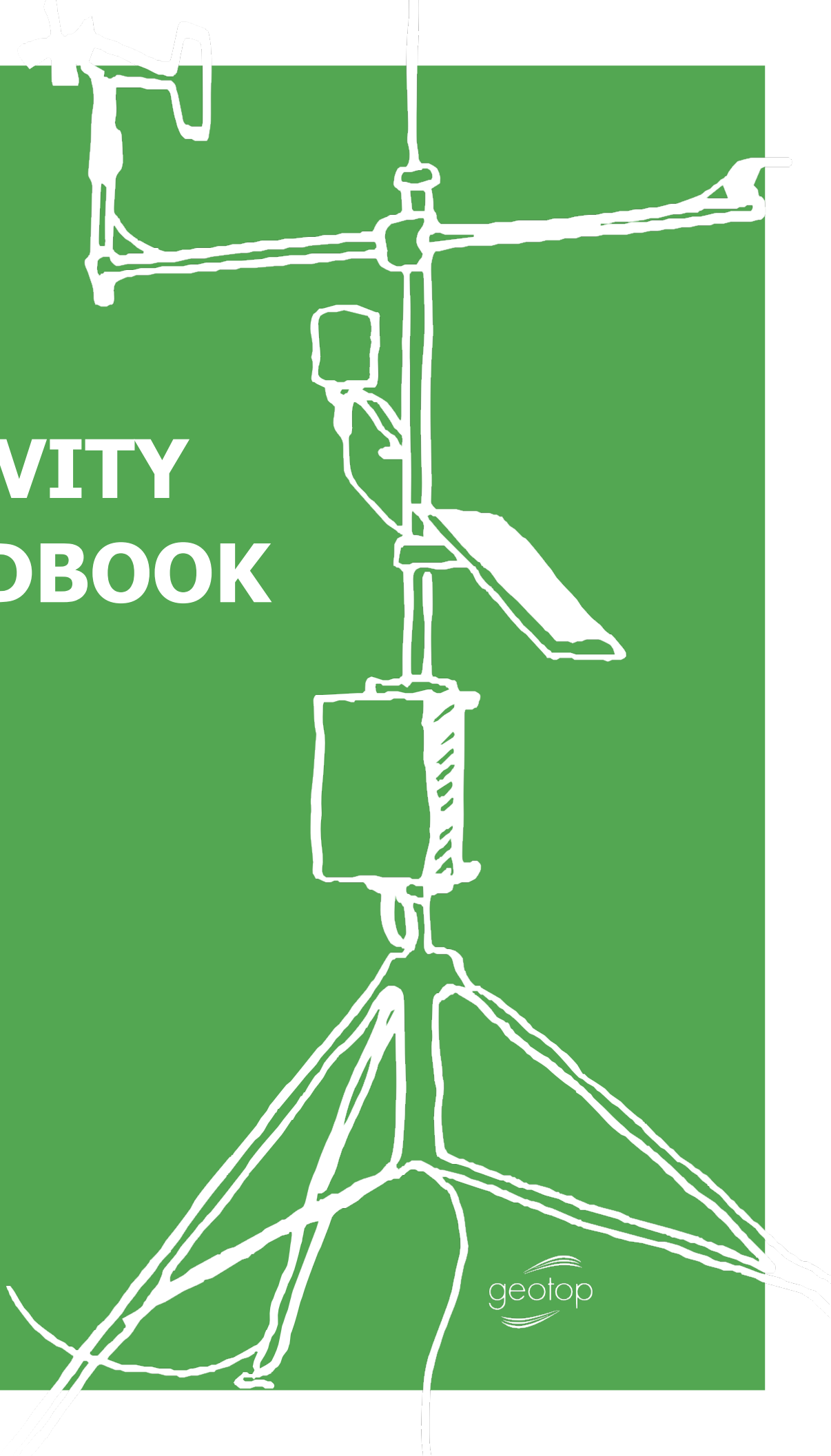
ACTIVITY HANDBOOK



geotop

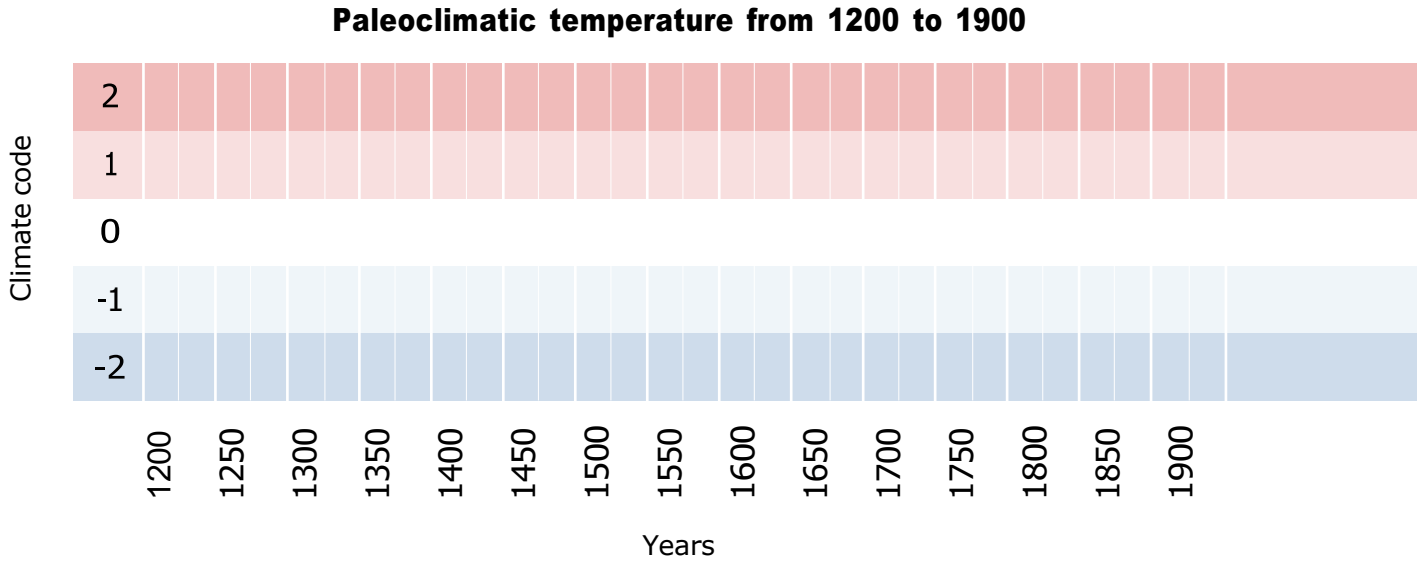
ACTIVITY HANDBOOK

This activity handbook complements the comic book "The climate stories of Aklavik : a journey into the past". You can now lead your own quest and be a climate scientist for a day.

The weather station in Aklavik was built in 1928. Before that, no temperature data are compiled. Thanks to natural archives, local knowledge and historical archives, you will be able to reconstruct the paleoclimate around Aklavik.

Check the appropriate case below every time you find a new clue on the climate of the past.

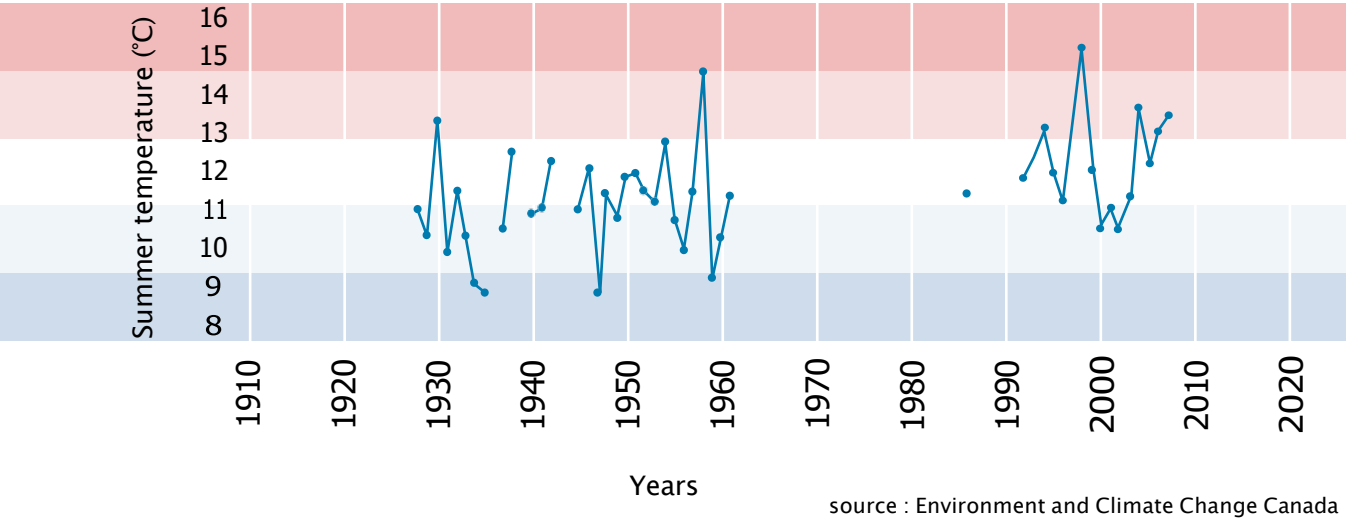
Timeline



Your quest is to fill the timeline by finding clues about the climate of the past in the following pages.

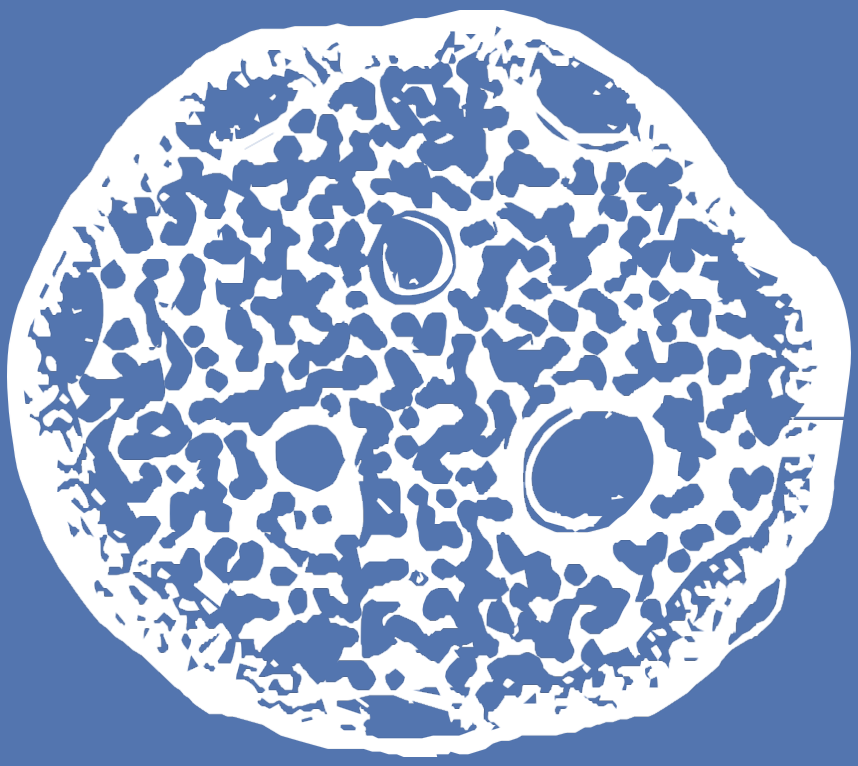
I guess it's time for an adventure!

Mean summer temperature in Aklavik from 1928 to 2007



source : Environment and Climate Change Canada

ACTIVITY 1 :



Microfossils

The pollen grains from trees, plants and ferns that accumulate in the peatland can help us to reconstruct past vegetation and climate. Help Michelle Garneau's team and identify the pollen grains that accumulated in the core you collected.

At page 7, there is an information sheet describing 6 different trees and plants and their associated pollen grains. Three of them grow in a more temperate climate, while the other three grow in an Arctic-like climate.

Go to page 6 to count the pollen grains of all the species you see in the two different samples. Note that the peat samples were taken at different depths in the core, which means that they correspond to different years of accumulation.

When you are done counting and identifying the pollen grains, use the table on top of page 6 to find the climate code of each sample and add these clues to the timeline at page 2.

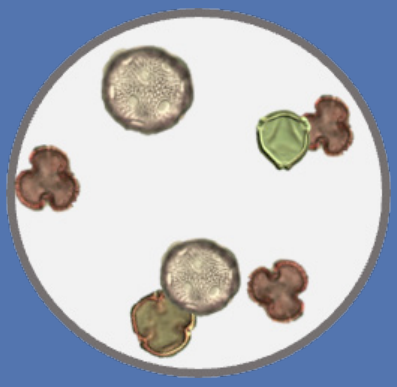
a peatcore sample being packed
by Professor Michelle Garneau

Activity 1
Microfossils

temperate flora	arctic flora	climate code
> 7	= 0	2
> 4	< 4	1
= 4	= 4	0
< 4	> 4	-1
= 0	> 7	-2

sample #1

Name of core:
Inuvik-Exp-Geo1
Depth in core:
9-10 cm
Associated year:
1525



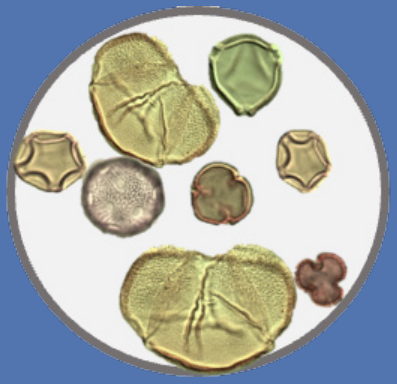
counts

Picea mariana:
Betula papyrifera:
Alnus crispa:
Total Temperate: ☐
Oxyria digyna:
Saxifrage oppositifolia:
Arenaria humifusa:
Total Arctic: ☐

Sample #1: Year _____
Climate code _____

sample #2

Name of core:
Inuvik-Exp-Geo1
Depth in core:
16-17 cm
Associated year:
1200



counts

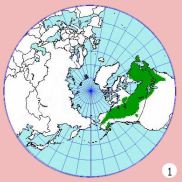
Picea mariana:
Betula papyrifera:
Alnus crispa:
Total Temperate: ☐
Oxyria digyna:
Saxifrage oppositifolia:
Arenaria humifusa:
Total Arctic: ☐

Sample #2: Year _____
Climate code _____

Temperate flora

Picea mariana

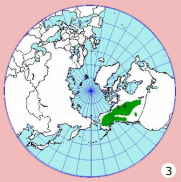
Black spruce


1


1

Betula papyrifera

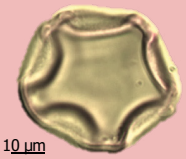
Paper birch

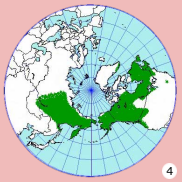

3


2

Alnus crispa

Green alder




4

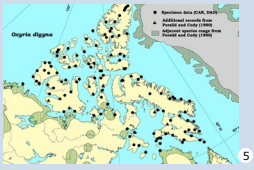

4

Arctic flora

Oxyria digyna

Mountain sorrel

Qunulliq

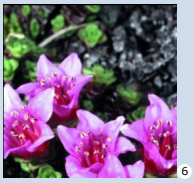

5


5

Saxifrage oppositifolia

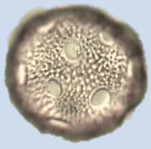
Purple saxifrage


6


6

Arenaria humifusa

Low sandwort




8


7

1. https://www.flora.dempstercountry.org/0.Site.Folder/Species.Program/Species.php?species_id=Pice.mari
2. http://www.northernontarioflora.ca/description.cfm?speciesid=1000176
3. http://www.flora.dempstercountry.org/0.Site.Folder/Species.Program/Species.php?species_id=Betu.papy
4. http://www.flora.dempstercountry.org/0.Site.Folder/Species.Program/Species.php?species_id=Alnus.crispa
5. https://nature.ca/aaflora/data/www/pgoxdi.htm
6. https://www.naturewatch.ca/plantwatch/purple-saxifrage/
7. https://nature.ca/aaflora/data/www/caarhu.htm
8. https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:151291-1

ACTIVITY 2 :

Local knowledge

The stories that tell the elders and knowledge holders are important to remember our past. Here you have the whole story from the elder. Assuming the elder in the story was trapping when he was young, in 1920, what could you learn on the climate of that year from the story?

"I could tell you a story that I heard from an elder. And this was about maybe in the late 80's and I used to work at the senior citizens home when this elder was asking me about how is it outside? And I was telling him gee it's so warm to be winter out there I don't know I wonder if we will even get a winter. He asked me what month it was, and I said it was November and then in November it was still too warm for freezing up or anything and he told me he recalls when he was a young man that it was so warm one winter that when they started trapping November 1st, they had to go to their traps with canoe cause it was just so warm. All this year, that we are going through it is just a cycle, it must be a cycle. "

event description	climate code
an exceptionnally warm event	2
a warm event	1
an ordinary/normal event	0
a cold event	-1
an exceptionnally cold event	-2

Year: _____

Climate code : _____

You have now a new piece of information! Add it to the timeline at page 2

ACTIVITY 3 :

Historical Archives

temperature of the past

Historical archives can be many things: novels, journals, life stories, etc. They can give precious pieces of information about the climate of the past!

Marie-Michèle gave you excerpts of the Hudson Bay Company (HBC) Post Journals from Aklavik, one from August 1933 and the other one from August 1934.

The Hudson Bay Company is known in Canada to have kept a lot of climatic and weather information in their Post journals. HBC established a trading post in Aklavik in 1912, and Post journals were kept from 1929 to 1935.

- Go to the next page and read the excerpts
- Underline the words associated to cold temperature in blue and words associated to warm temperature in red
- Which year seems to be colder? _____
- Go to the timeline at page 2. Does it correspond to what the instrumental temperature shows? Yes or No?

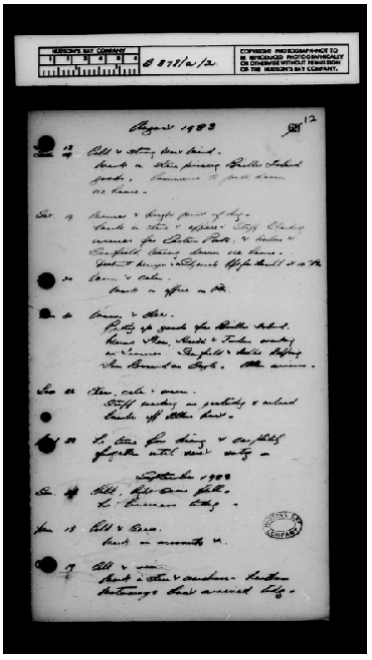
HBC Trading Post in Aklavik, before 1920
(Archive society of Alberta)

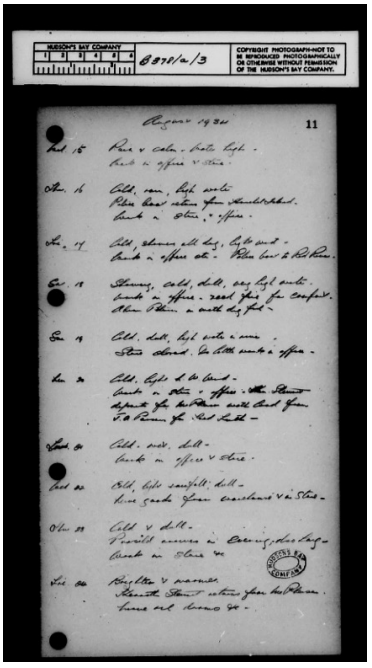
ARCHIVES

August 12:	Dull & low clouds
August 13:	Dull, but clouds higher
August 14:	Cold & low clouds
August 15:	Dull & damp
August 16:	Dull & colder
August 17:	Warmer
August 18:	Cold & strong west wind
August 19:	Warmer & bright part of day
August 20:	Warm & calm
August 21:	Warm & clear
August 22:	Clear, calm, warm

August 12:	Light south-west breeze, water rising, cold
August 13:	Dull & light rain
August 14:	Light rain & dull, cold
August 15:	Rain & calm, water light
August 16:	Cold, rain, light water
August 17:	Cold, shower all day, light water
August 18:	Showering, cold, dull, very light water
August 19:	Cold, dull, light water
August 20:	Cold, light north-west wind
August 21:	Cold, …, dull
August 22:	Cold, light, rainfall, dull

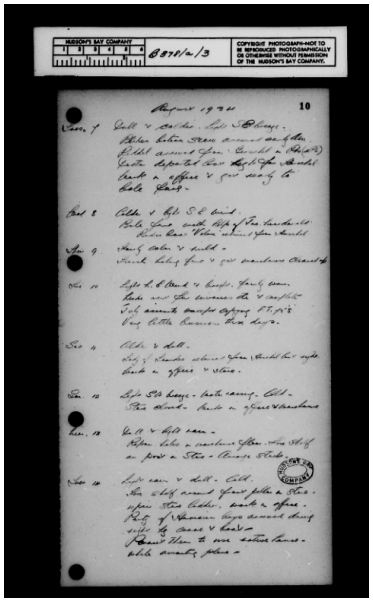
August 1933

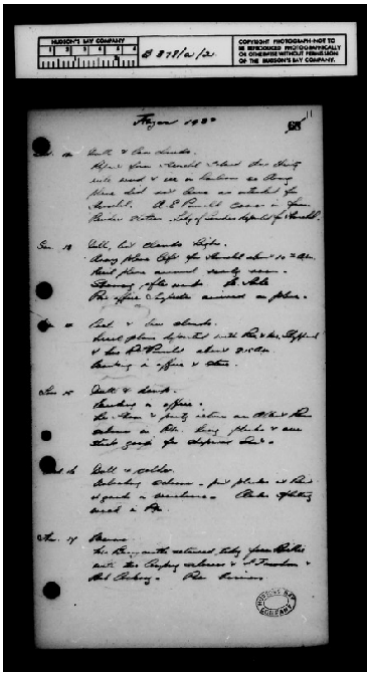




HBC Post journal 1933
(1MA30_0196; 1MA30_197)

August 1934

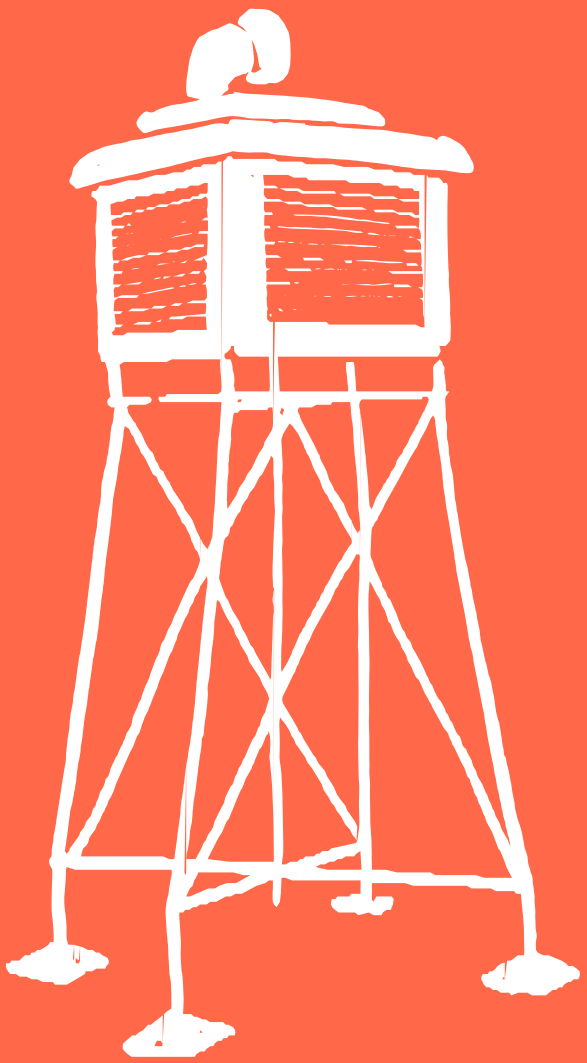




HBC Post journal 1934
(1MA30_0242; 1MA30_243)

Light water indicates that the level of the water in the river is low.

ACTIVITY 4 :



Instrumental data

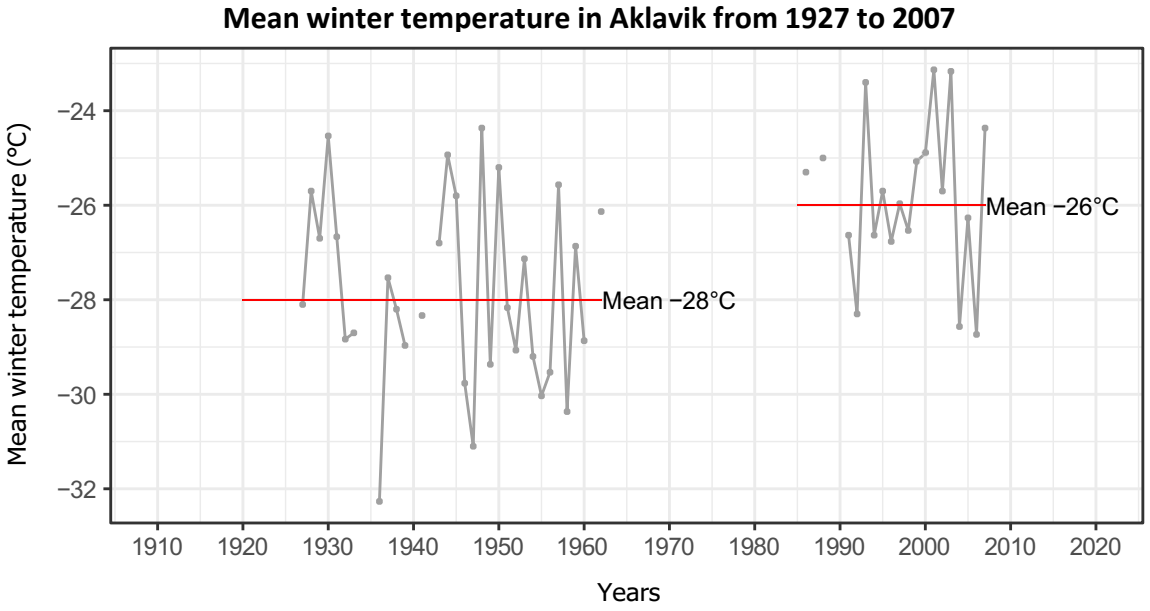
The methods presented so far gave you information on the climate in summer. From the conversations you heard from local members, you start to wonder what about the other seasons? And mostly, what about winters ?

Observations of past winter temperature

To help you answer your question, you visit the historical data website of Environment and Climate Change Canada and see the graphic below. It shows the mean temperature in winter in Aklavik from 1927 to 2007.

Do you notice how winters appear to be warmer since 1990?

What is the difference between the two mean temperatures? _____ °C



Instrumental data

Ice conditions in the past

When we think about winters, we also think about snow and ice! Look at the old photographs taken in 1954[1]. That year, the ice in the river broke-up[2] on June 4th around the community of Aklavik, and there was still a lot of ice.

You wonder if the presence of ice in the river in early June is common nowadays with climate change. You reach out to people living in the area and decide to call the Hamlet of Aklavik.

The person on the phone tells you:

"It is quite exceptionnal and the last time it happened was 2001"

In the period 1996-2014[3]
Average break-up: May 27th
Earliest: May 19th, 1998
Latest: June 5th, 2001

West Channel north of Aklavik on June 4th, 1954

Peel Channel in Aklavik on June 5th, 1954

1. Brown, R. J. E. (1957). Observations on break-up in the Mackenzie River and its delta in 1954. Journal of Glaciology 3, 133-141.
2. The ice break-up date is when the ice on the river starts to move and is no longer fixed to the shore in spring
3. Hamlet of Aklavik in Arctic Borderlands Ecological Knowledge Society (2013). Break-up date of Peel River at Aklavik, Indicator Report No. 22

ACTIVITY 5 :

Tree rings

On the next page, you can see a sample from the dead sunk tree that Professor Étienne Boucher gave you. You realize that a section of this sample matches the pattern of an old living tree.

Now, let's see how the climate was in 1810.

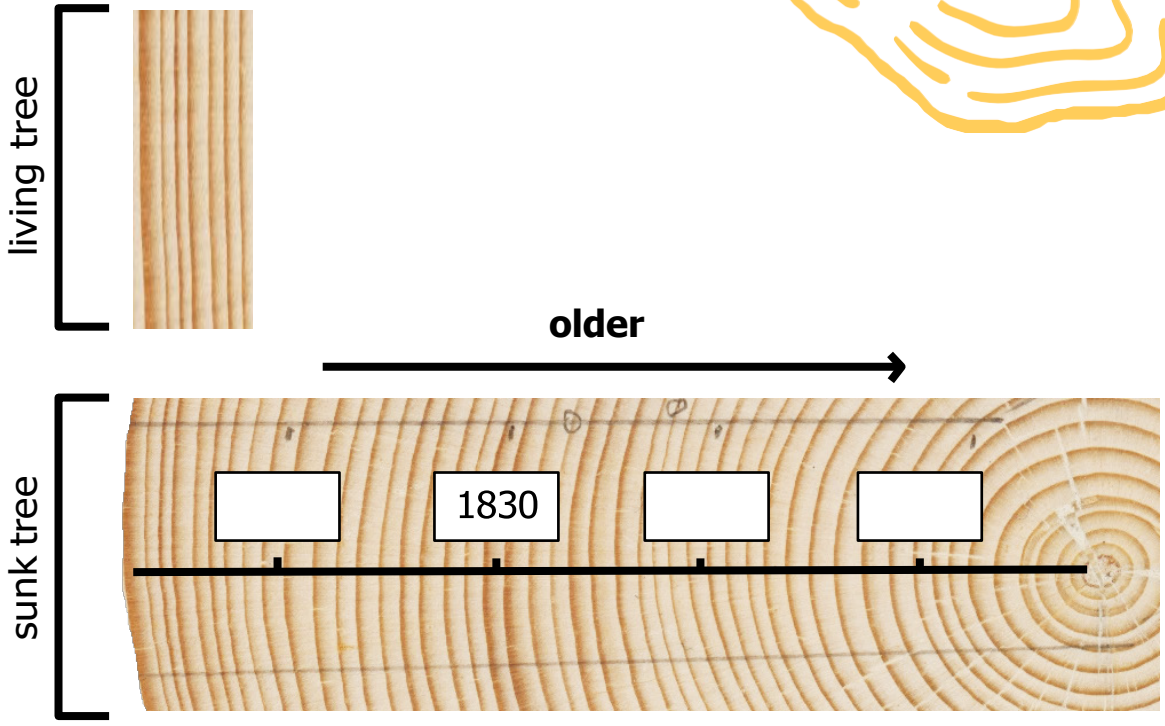
To do so, measure with your ruler the width of the tree ring of that given year on the black line and use the color table to identify the climate code.

Did the tree grow fast or slow in 1810?

tree ring width	climate code
> 4 mm	2
>= 3 mm & < 4 mm	1
>= 2 mm & < 3 mm	0
>= 1 mm & < 2 mm	-1
< 1 mm	-2

Did you know?

Black spruce can be older than a hundred years!



Tree-ring width in 1810 : _____

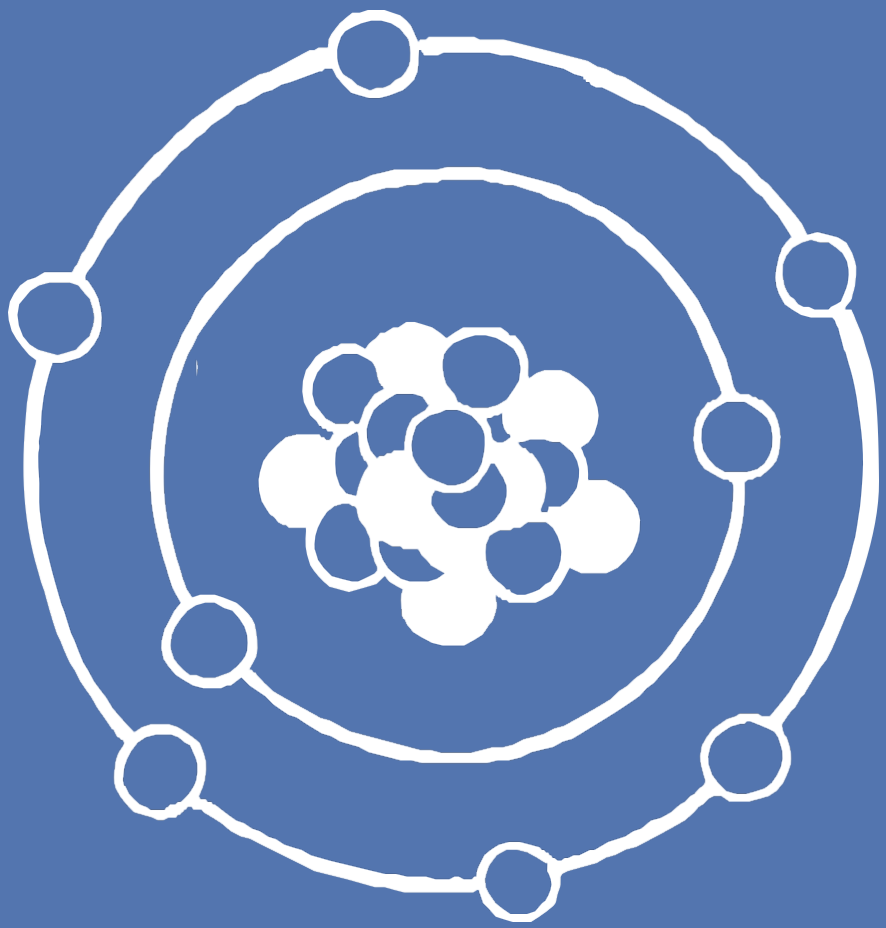
Climate code : _____

Write your answer in the timeline at page 2! Your quest is progressing

* Note : If the length of the red line is not 10 mm on your ruler, you will have to use the following equation: —— = 10 mm

$$\textit{corrected tree ring width} = \frac{\textit{10 mm x measured tree ring width in 1810}}{\textit{measured length of the red line}}$$

ACTIVITY 6 :



Stable isotopes

You receive the results from Geotop in your mailbox. It's from Professor Anne de Vernal. It is the last piece of evidence you needed!

Go to pages 22 and 23, and place the data from the table in the graphic. Then, you can identify the climate code of each sample.

Note that the sediment samples were taken at different depths in the core, which means that they correspond to different years of accumulation.

Anne helps you to interpret the results at page 24!

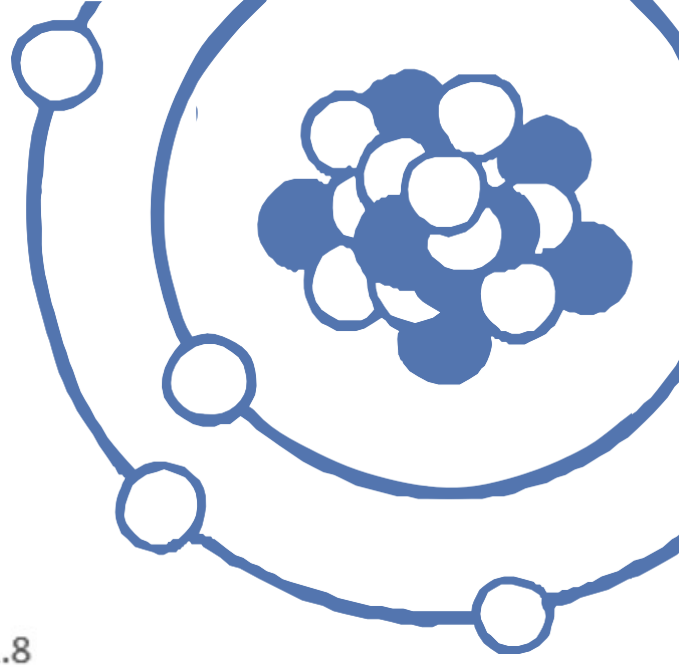
aerial view of the Mackenzie Delta, near Aklavik

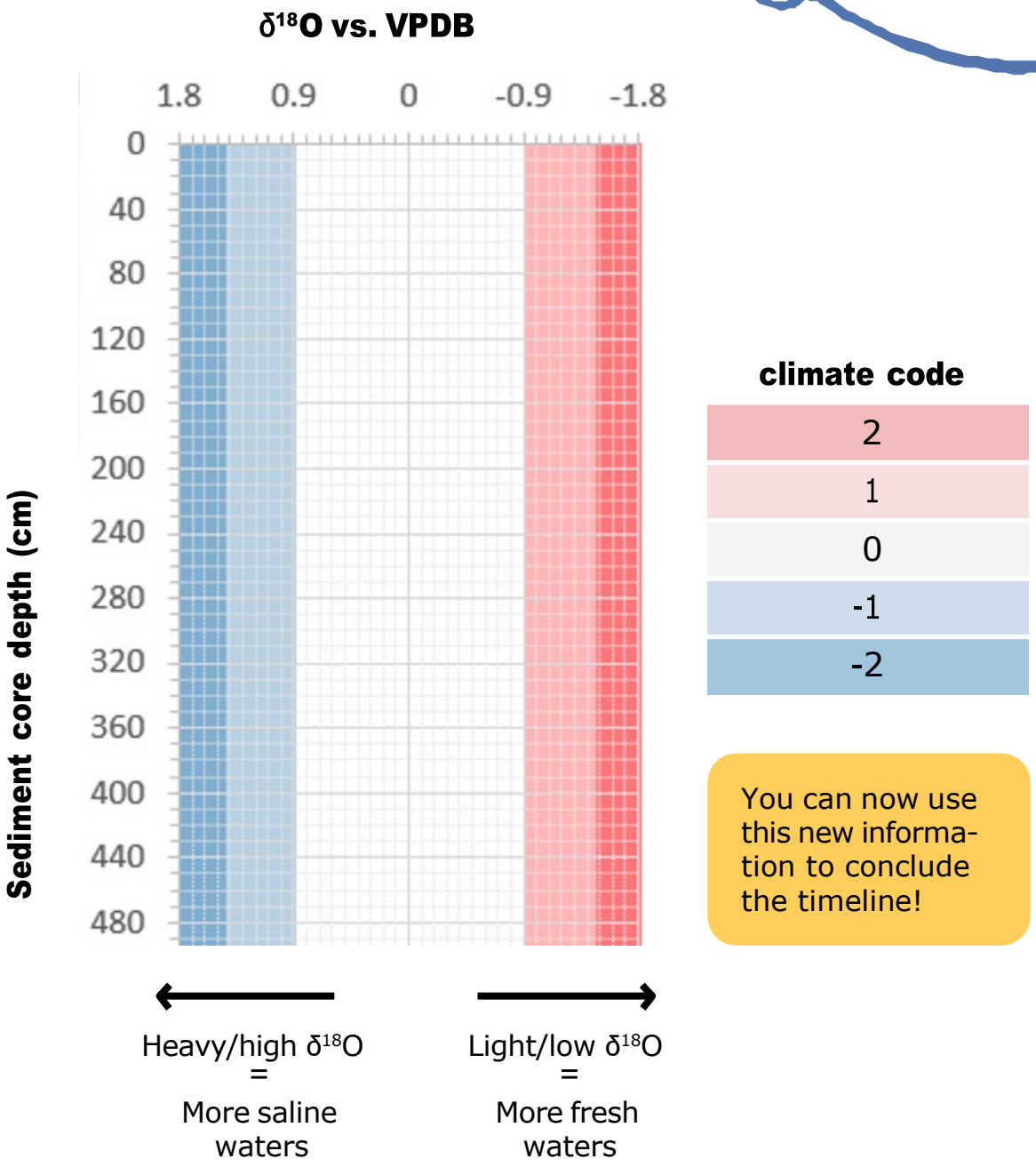
Stable isotopes

Place the data from the table in the graphic. Then, you can identify the climate code of each sample.

depth in core	associated year	$\delta^{18}O$	climate code
205 cm	1325	-0.2	
162 cm	1450	1.8	
112 cm	1625	1.7	
90 cm	1700	1.3	
40 cm	1875	-0.7	

Check in your booklet supplementary material for more information about the oxygen stable isotopes and how to date sediment samples in cores!

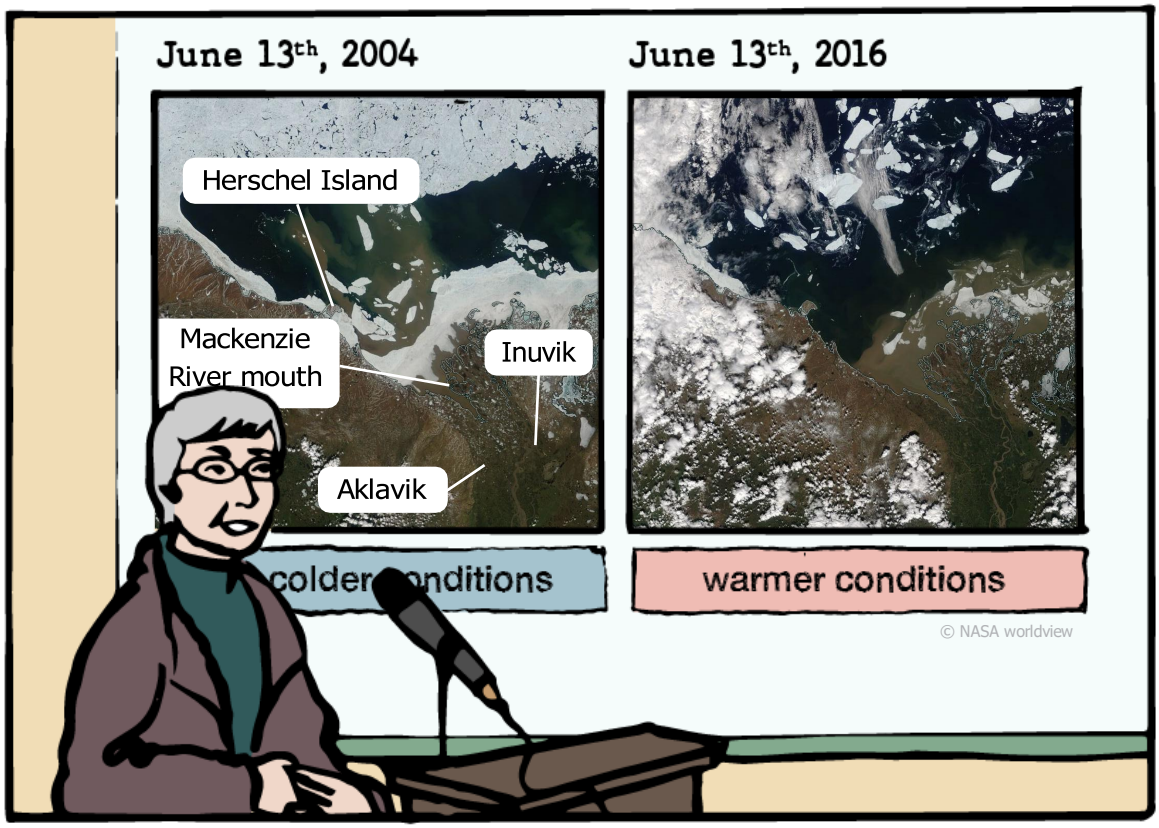




climate code
2
1
0
-1
-2

You can now use this new information to conclude the timeline!

Here, you can see two aerial photographs of the study area with the Herschel Island – Qikiqtaruk, that you know well now! You can also see the Mackenzie River mouth and the communities of Inuvik and Aklavik. They were taken on the same day, but at two distinctive years. Do you see differences?



In these shallow areas close to large rivers :

When the climate is colder, the snow and sea ice persist in summer and rivers discharge less fresh waters.

It results in more **saline waters**.

When the climate is warmer, there is more snow and sea ice melting in summer and rivers discharge more fresh waters.

It results in more **fresh waters**.

Conclusion

You have found all the clues!

Go back to the timeline and connect each dot with a line.

Was the climate warm in the far past (climate codes 1 and 2)?

_____

_____

How does it compare to the last decades?

_____

_____

_____

You can now share your findings with the communities!
It will sure lead to nice storytelling!

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