HL Paper 2
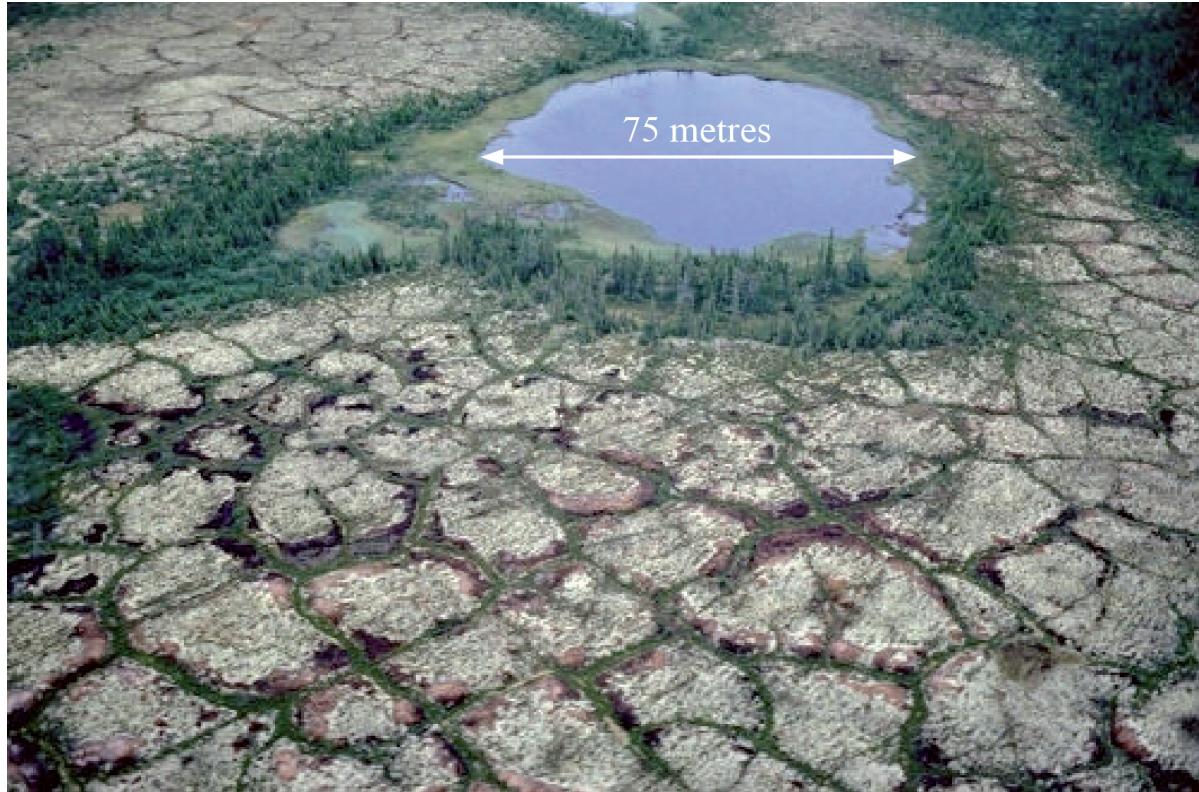
a. (i) Define the term *aridity*. [4]

   (ii) Define the term *infertility*.

b. Explain **three** factors, **other than** aridity and infertility, that affect the sustainability of human activities in extreme environments. [6]

c. "Periglacial areas offer more opportunities for human activities than hot, arid areas." Discuss this statement. [10]

The photograph shows a periglacial environment.

75 metres

a. Name and describe **two** landforms shown on the photograph. [2+2]

bi. Explain the process of solifluction. [3]

bii. Explain the formation of pingos. [3]

c. Examine the impacts of permafrost on human activities. [10]

a(i).Identify **one** type of cold extreme environment. [1]

a(ii)State **three** physical characteristics of the cold extreme environment that you identified in (a)(i). [3]
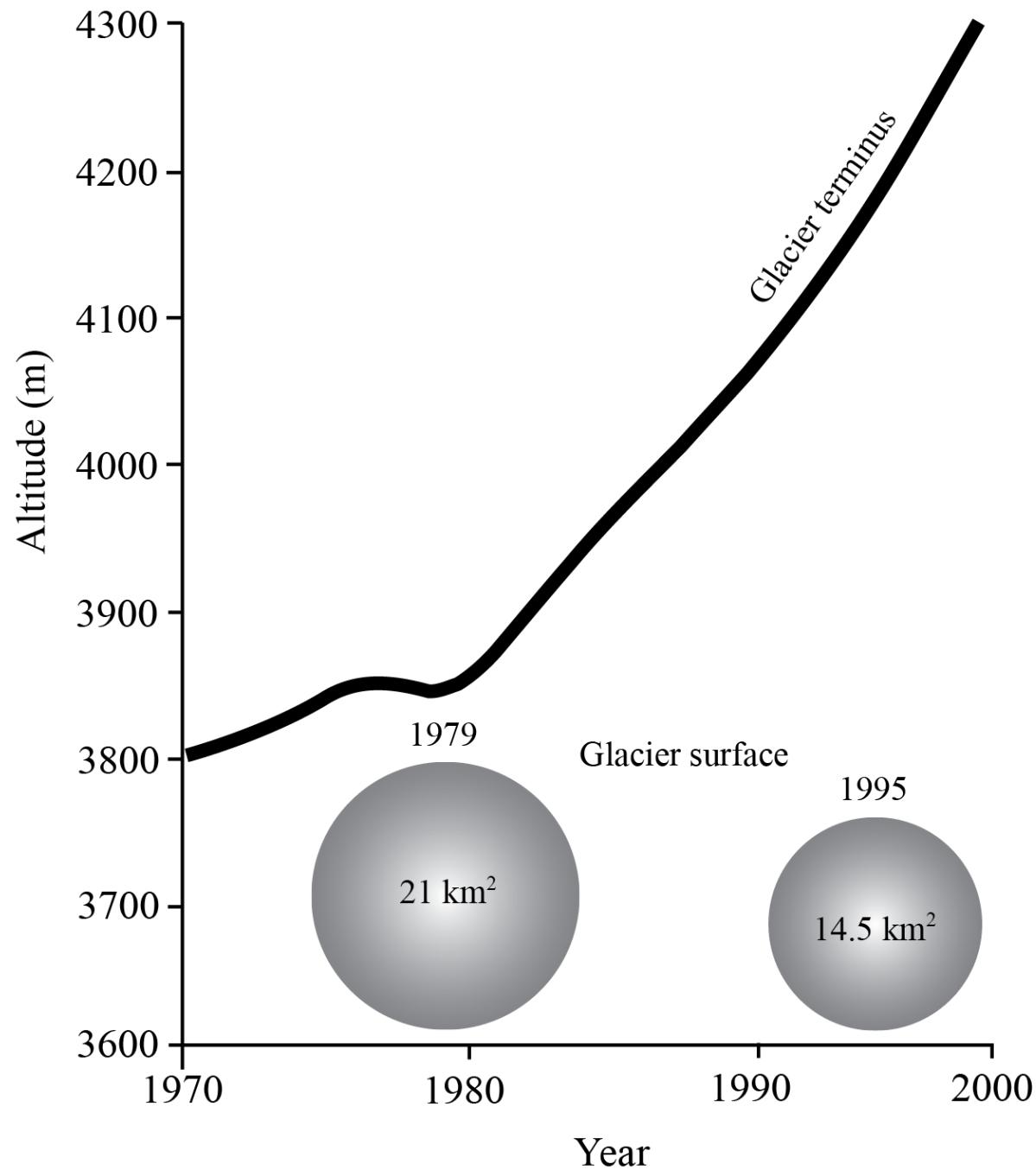
b. Explain why semi-arid areas are considered to be extreme environments. [6]

c. "Global climate change will prevent people from living in extreme environments." Discuss this statement with reference to **one or more** extreme [10] environments.

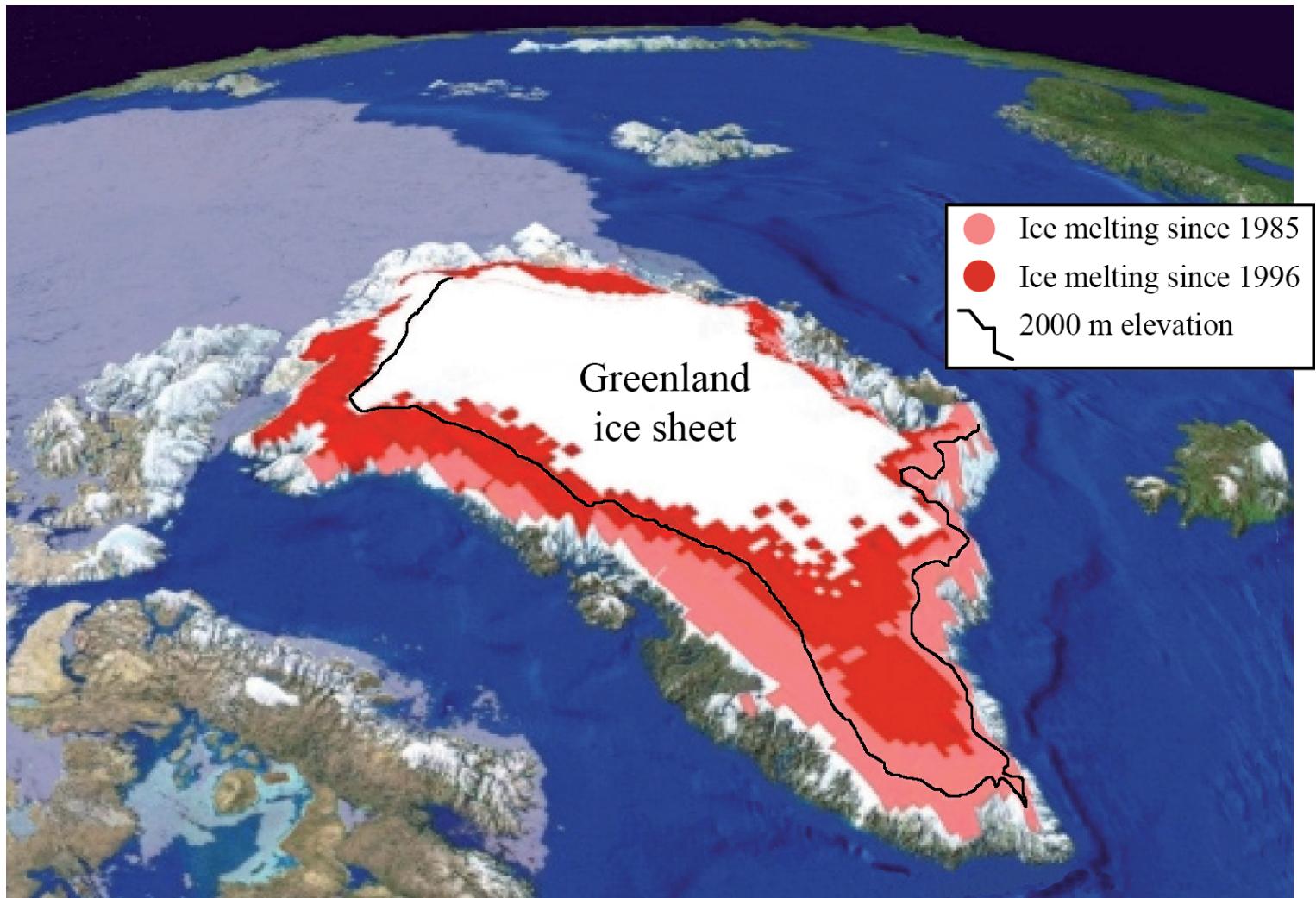The graph below shows the retreat (by altitude) and the surface area of the Santa Rosa glacier in Peru.

[Source: Peru National Communication to the UNFCCC2001]

a. Referring to the graph, describe the changes in the terminus of the Santa Rosa glacier from 1970–2000. [4]

b. Explain the processes involved in the advance and retreat of glaciers. [6]

c. Discuss the main environmental problems caused by tourism in **one** extreme environment. [10]

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ai. Define *glacial environment*. [2]

aii. Define *periglacial environment*. [2]

b. Explain how and why glaciers retreat. [3+3]

c. "Periglacial areas offer more opportunities for human activity than glacial areas." Discuss this statement. [10]

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a. (i) State **and** locate **one** example of mineral extraction in an extreme environment. [4]

   (ii) Outline **one** economic reason why the mineral identified in (a)(i) is extracted in this extreme environment.

b. Explain **two** physical challenges for resource development posed by extreme environments. [6]

c. Examine why desertification has become a problem in some parts of the world. [10]

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a.i. Briefly outline **two human** factors that are possible causes of desertification in a hot, arid environment. [2]

a.ii. Briefly outline **two physical** factors that influence the occurrence of flash floods in hot, arid environments. [2]

b. Explain **three** reasons why there are concentrations of people in some parts of hot, arid areas. [6]

c. Examine the severity of the different challenges for resource development in periglacial areas. [10]

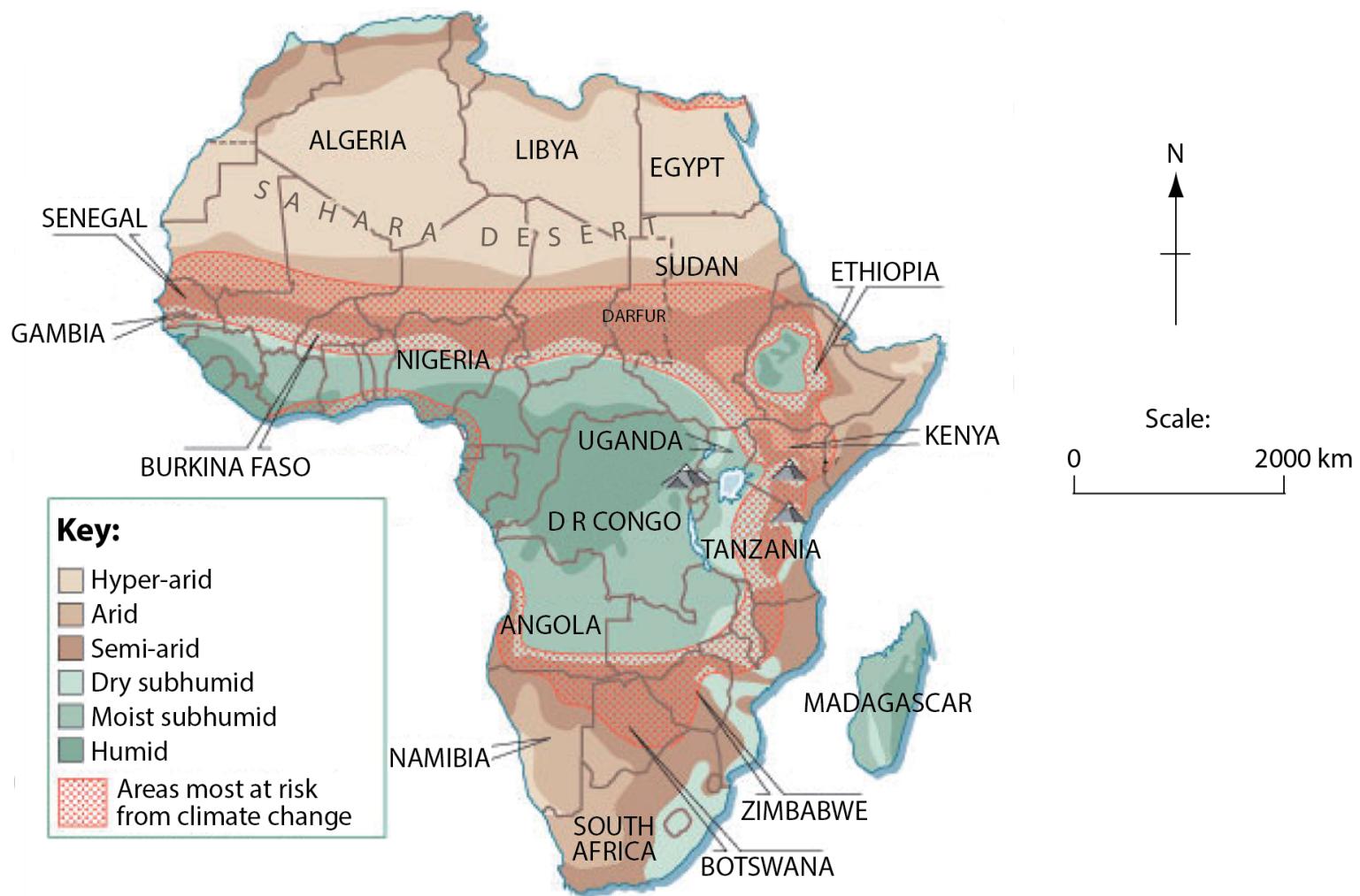
The image shows changes in the melting of the Greenland ice sheet.

[©University of Colorado CIRES, courtesy Russel Huff and Konrad Steffen]

a. Describe the changes that have taken place in the Greenland ice sheet since 1985.   [4]

b. Explain how and why glaciers and ice masses have sometimes advanced.   [3+3]

c. "Agriculture in hot, arid areas inevitably results in desertification." Discuss this statement.   [10]

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a. Outline **two** ways in which people have adapted their **outdoor** activities to extremes of weather in hot, arid environments.   [4]

b.i. Distinguish between the terms "accumulation" and "ablation" in the glacial environment.   [2]

b.ii. Explain **two** reasons why many glaciers are retreating.   [4]

c. "Global climate change will create more opportunities than challenges for indigenous populations." Discuss this statement, with reference to **one or more** extreme environments.   [10]
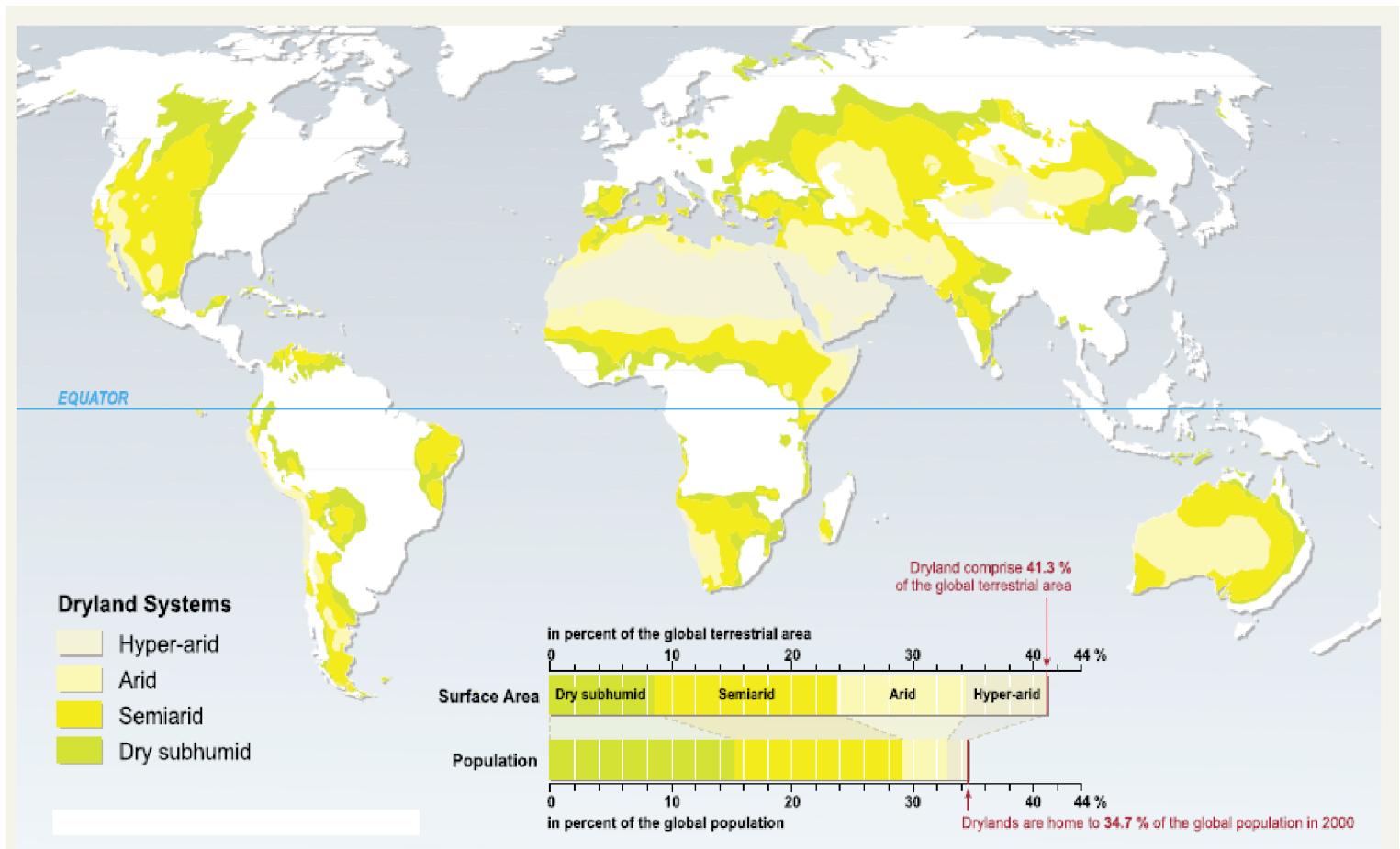
The map shows different levels of aridity in Africa and the areas at most risk from climate change.
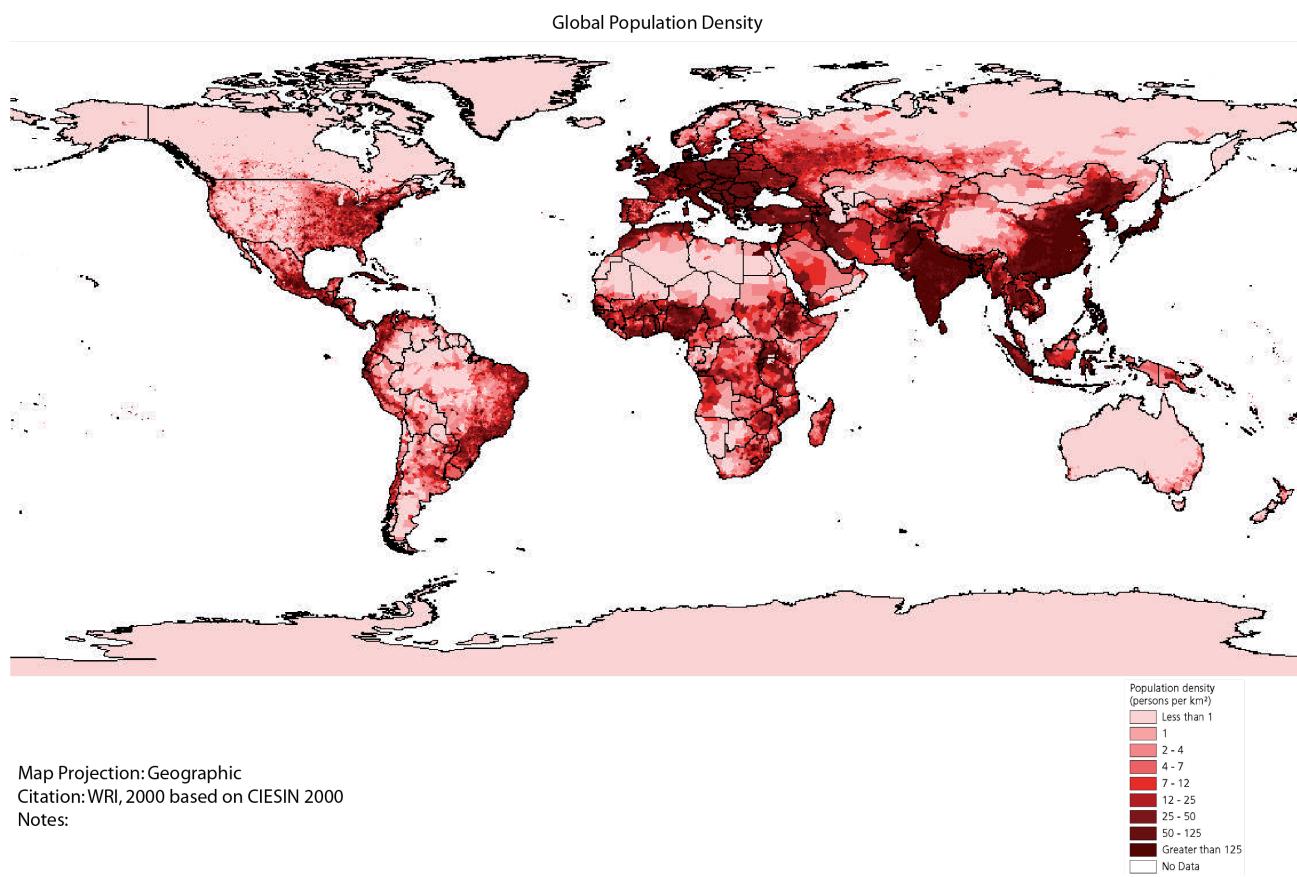

ALGERIA
LIBYA
EGYPT
SENEGAL
SAHARA DESERT
SUDAN
ETHIOPIA
DARFUR
GAMBIA
NIGERIA
BURKINA FASO
UGANDA
KENYA
D R CONGO
TANZANIA
ANGOLA
MADAGASCAR
NAMIBIA
ZIMBABWE
SOUTH AFRICA
BOTSWANA

N

Scale:
0   2000 km

Key:
Hyper-arid
Arid
Semi-arid
Dry subhumid
Moist subhumid
Humid
Areas most at risk from climate change

[Source: *The Economist*, 12 May 2007]

a. Describe the distribution of hyper-arid and semi-arid regions in Africa. [2+2]

b. Using located examples, suggest possible socio-economic impacts of climate change for arid and/or semi-arid environments. [6]

c. Examine the importance of water in the development of the landforms in any **one** extreme environment (glacial, periglacial, or hot, arid). [10]

The maps show world population density and the location of hot, arid environments.

Dryland Systems

	Hyper-arid
	Arid
	Semiarid
	Dry subhumid

in percent of the global terrestrial area

Dryland comprise **41.3 %** of the global terrestrial area

	0	10	20	30	40	44 %

Surface Area — Dry subhumid | Semiarid | Arid | Hyper-arid

Population

| 0 | 10 | 20 | 30 | 40 | 44 % |

in percent of the global population

Drylands are home to **34.7 %** of the global population in 2000

[Source: Millennium Ecosystem Assessment]

Global Population Density

Map Projection: Geographic
Citation: WRI, 2000 based on CIESIN 2000
Notes:

Population density
(persons per km²)

	Less than 1
	1
	2 – 4
	4 – 7
	7 – 12
	12 – 25
	25 – 50
	50 – 125
	Greater than 125
	No Data

a. Using the two maps, describe the population density in hot, arid areas. [4]

b. Explain how and why the following factors may influence population density in hot, arid areas: [6]

- human discomfort,
- inaccessibility.

c. Using examples, examine how extreme environments offer both challenges and opportunities for mineral extraction. [10]

The photograph shows an arid landscape.

ai+(i) Name the landform in the background of the photograph. [1+2+

(ii) State **two** processes of wind transport found in areas such as this.

(iii) State the direction from which the wind normally blows.

b. Explain the occurrence of flash floods in areas like the one shown in the photograph. [6]

c. "The opportunities for tourism outweigh the challenges." Discuss this statement with reference to **one** extreme environment. [10]

a. Describe the climatic characteristics of **either** periglacial **or** glacial environments.   [4]

b. Explain **two** landforms associated with deposition by glaciers.   [3+3]

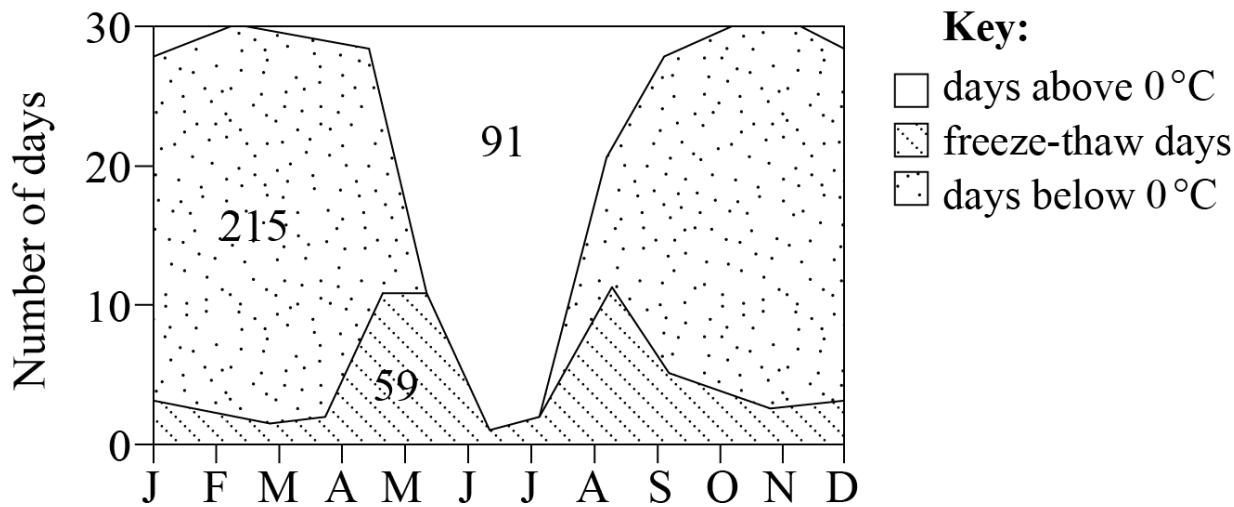c. Examine the opportunities and challenges for agriculture in hot, arid areas.   [10]

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a. The photograph shows a periglacial landscape in southern Iceland.   [2+2]

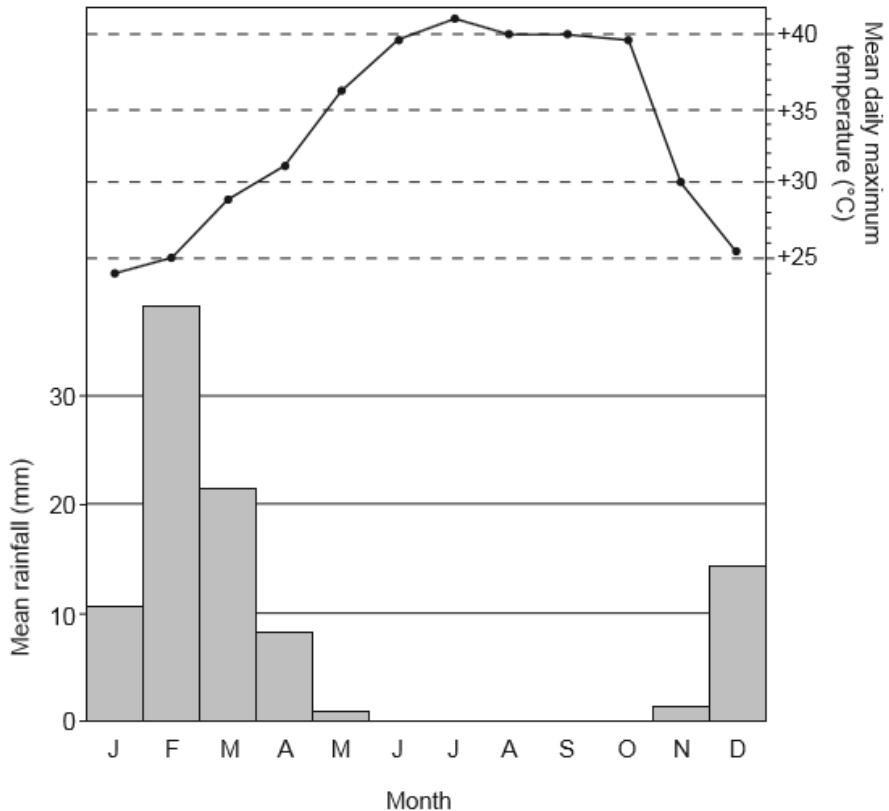[Source: Copyright Bruce Molnia, Courtesy Earth Science World Image Bank (http://www.earthscienceworld.org/images)]

Briefly describe **two** erosional landforms shown in this photograph.

b. Explain **three** ways in which the characteristics of periglacial environments hinder resource development.   [2+2+

c. With reference to **one or more** extreme environments, discuss whether human activities can be sustainable.   [10]

The diagram shows temperature conditions for a year in a periglacial region of the northern hemisphere.

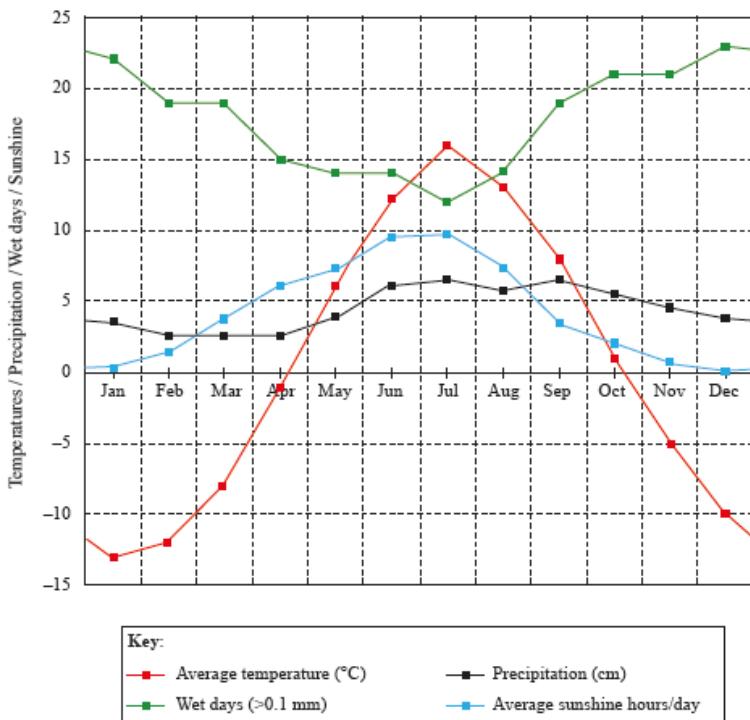[Source: H French, *The Periglacial Environment*, Longman, (1996), page 24]

ai. Define the term *freeze-thaw*.   [1]

aii. Describe the seasonal variations in the number of freeze-thaw days.   [3]

b. Explain the importance of freeze-thaw cycles and solifluction processes for the development of periglacial landforms.   [6]

c. Examine how the physical characteristics of any **one** extreme environment (glacial, periglacial, or hot, arid) affect resource development.   [10]

b. With reference to a **named** hot, arid environment, explain **two** geographic factors (**other than** climate) that can make them extreme.   [6]

c. Contrast the landforms that result from erosional and depositional glacial processes.   [10]

a. Outline **two** physical causes of aridity in hot, arid environments.   [4]

b. Explain **two** processes of weathering commonly found in hot, arid environments.   [6]

c. "Human activity within periglacial environments is unsustainable." Discuss this statement.   [10]

a. The graph shows climatic data for an extreme arid environment.   [4]

(i) Identify the month with the highest rainfall.

(ii) Estimate the annual temperature range.

(iii) Suggest why October is a more challenging month for human activity than June.

b. Explain **two** processes of weathering or erosion that operate in hot, arid areas.   [6]

c. "All cold extreme environments are equally challenging for human activity." Discuss this statement.   [10]
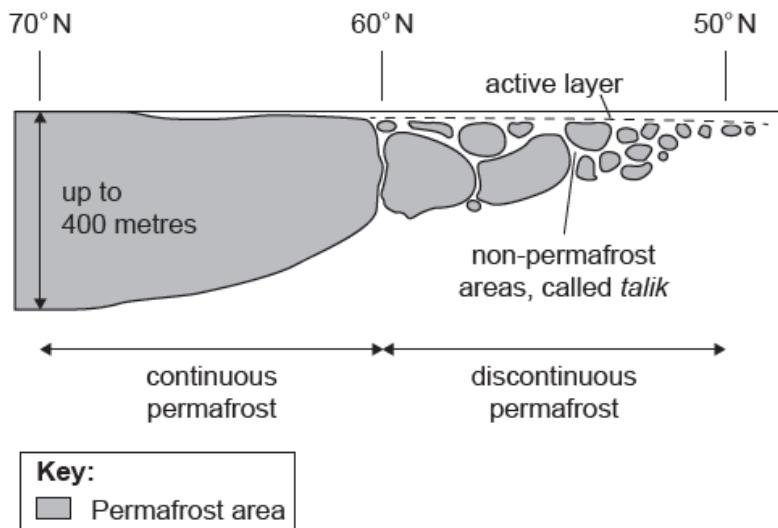
The climate graph is of Arkhangelsk (64°N, 60°E), a periglacial area in northern Russia.
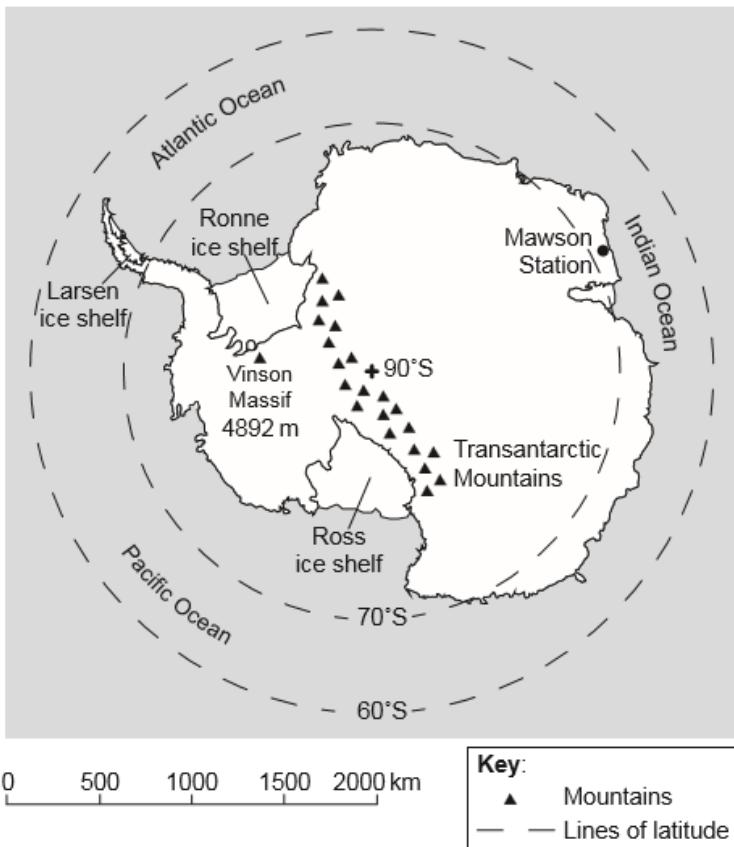
[Source: www.arkhangelsk.climatemps.com]

a. From information shown on the graph: [4]

(i) State the number of months of the year when the average temperature is below 0°C.

(ii) Estimate the annual temperature range in °C.

(iii) Apart from temperature, outline **one other** climatic characteristic shown on the graph that indicates Arkhangelsk is located in an extreme environment.

b. Explain **three** ways in which people have adapted to the extremes of weather and climate in periglacial areas such as Arkhangelsk. [6]

c. "Desertification is the main environmental risk for agriculture in hot deserts and semi-arid areas." Discuss this statement, with reference to examples. [10]

The diagram shows a cross-section of the location of permanently frozen ground (permafrost).

[Source: *Conceptual Frameworks in Geography*, by Alan Clowes and Peter Comfort, copyright Pearson Education Limited, 1987, page 228]
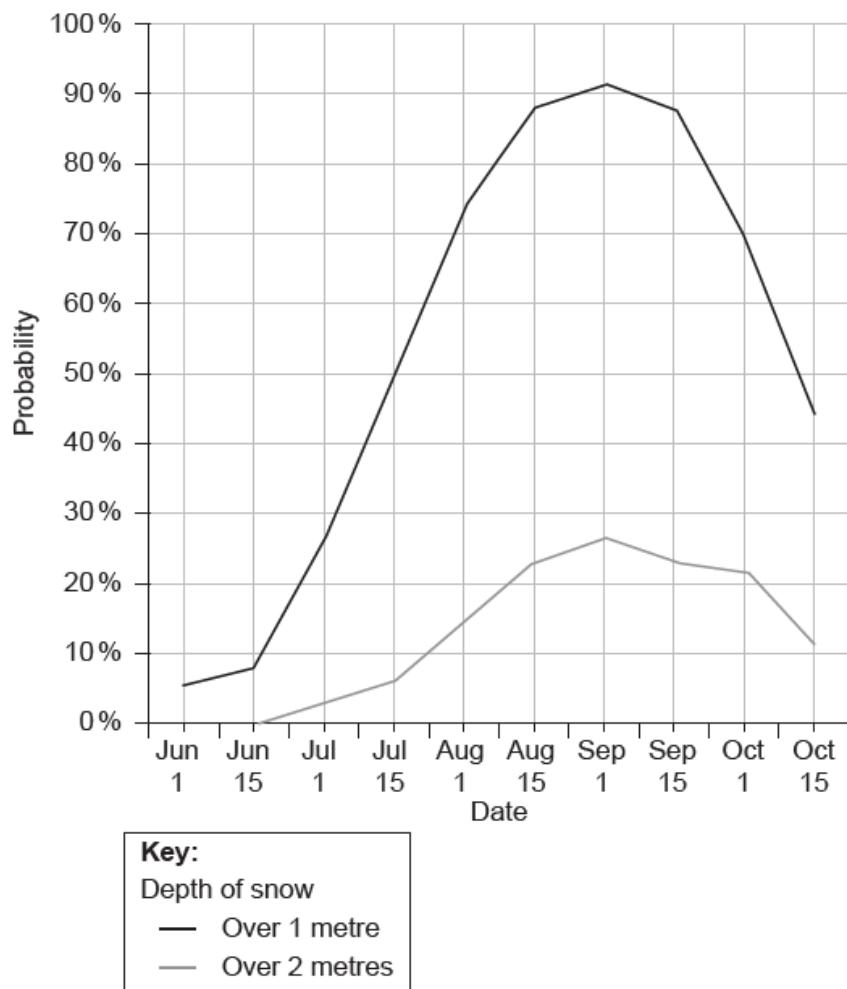
a. Describe how the characteristics of permafrost vary with latitude. [4]

b.i. Outline how the seasonal changes taking place in the active layer differ between 50°N and 60°N. [2]

b.ii. Explain **two** ways in which the active layer creates challenges for settlement and/or communications in a permafrost area. [4]

c. "The opportunities for mineral extraction outweigh the challenges in hot, arid areas." Discuss this statement. [10]

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a. The map shows a polar view of the Southern Hemisphere and locates Antarctica, an area experiencing an extreme environment. [4]

[Source: © International Baccalaureate Organization 2016]

(i) Estimate the distance of Mawson Station from the South Pole.

(ii) Estimate the latitude of the Vinson Massif.

(iii) State **two** reasons why most of Antarctica is covered in ice.

b. Referring to **at least one** example, suggest **three** reasons why mineral extraction has led to the growth of settlements in extreme environments. [6]

c. Using located examples, discuss the opportunities and risk associated with the use of irrigation in hot, arid environments. [10]
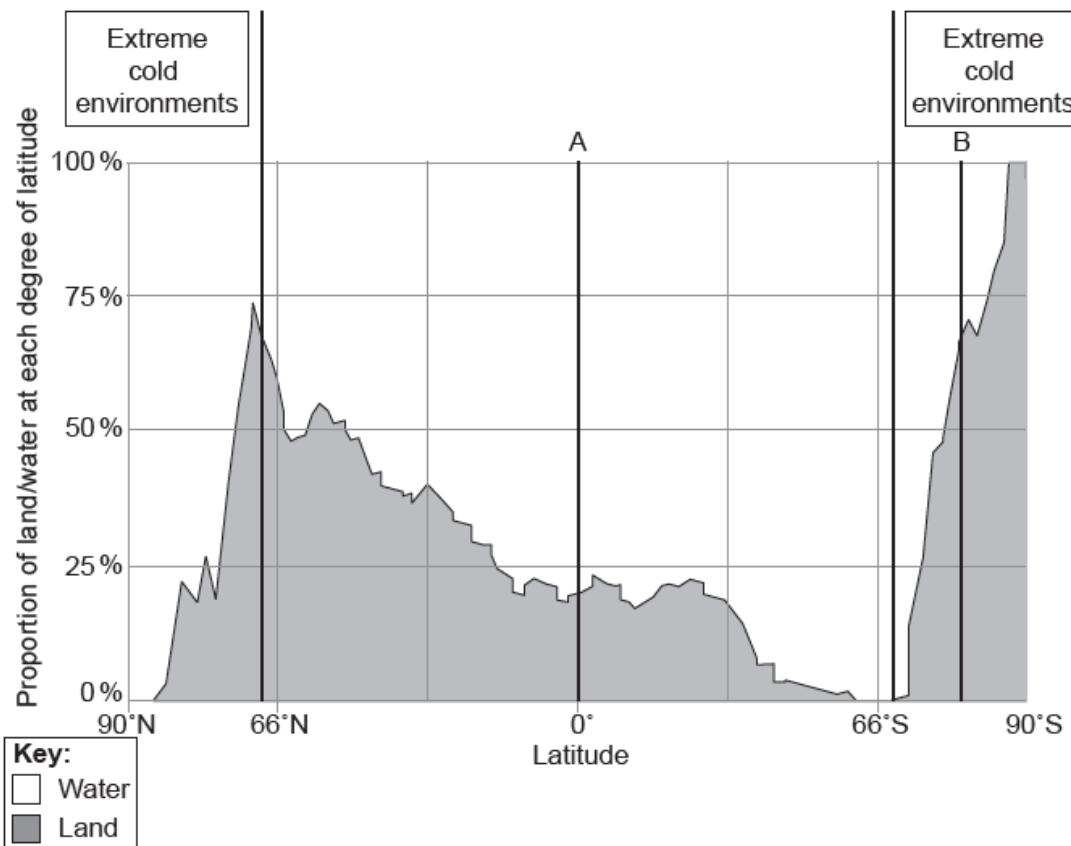
The graph shows the probability (likelihood) of the depth of snow on a ski field being over 1 metre, and over 2 metres, between June and October.

[Source: Michael Paine]

a.i. State the earliest date on which there is a 50 % probability of snow depth exceeding 1 metre. [1]

a.ii. Estimate the probability of snow depth exceeding 2 metres on 1 September. [1]

a.iii Briefly explain how the graph provides evidence that this ski field is located in the southern hemisphere. [2]

b. Explain **two** environmental impacts of tourism in **one named** extreme environment. [6]

c. Compare the importance of water and wind in the development of landform features in hot, arid areas. [10]

The diagram shows the proportions of land and water at each degree of latitude and the locations of some cold extreme environments.
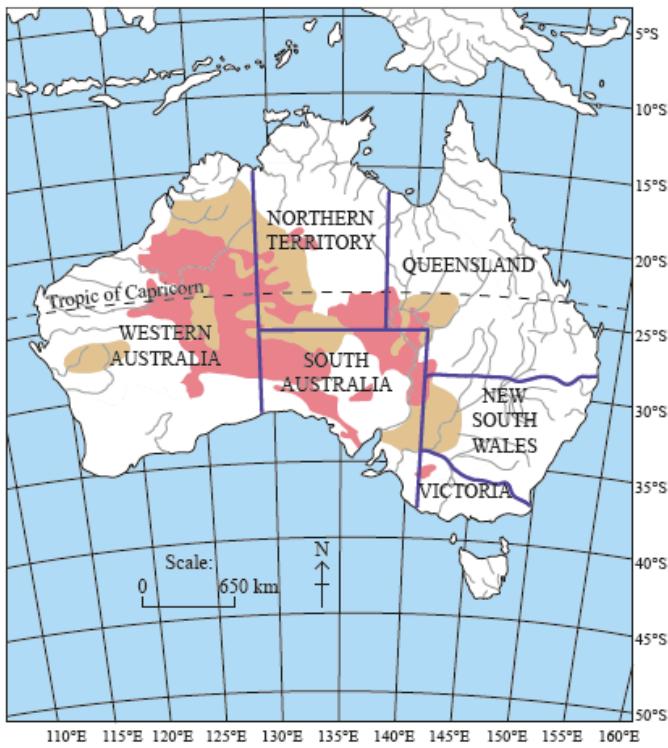
[Source: adapted from http://radicalcartography.net]

a. (i) Estimate the latitude at which the percentage of land is highest in the Northern Hemisphere. [4]

(ii) State **one** reason why extreme cold environments can even be found at latitude A.

(iii) Briefly outline the seasonal variations in temperature likely to be found at latitude B.

b. Explain the characteristics **and** formation in periglacial environments of: [6]

(i) patterned ground;

(ii) thermokarst.

c. Referring to examples, evaluate the varied economic opportunities in hot, arid environments. [10]

Optional Theme C — Extreme environments

6. The map of Australia shows regions that are at high risk of desertification.
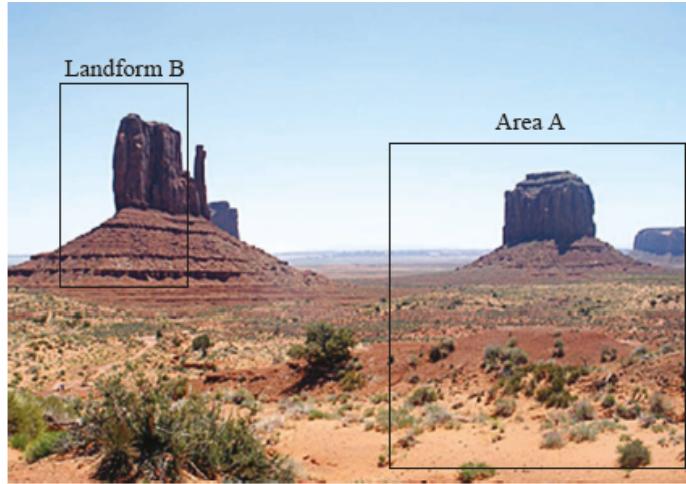
Key:

■ Existing deserts
□ Areas with a high risk of desertification
〜 Rivers

a. (i) Define the term *desertification*.   [4]

   (ii) Describe the pattern of areas with a high risk of desertification shown on the map.

b. Suggest **three** reasons why some rainstorms in hot, arid environments result in flash floods.   [6]

c. Examine how human activity may be affected by global climate change in **one named** extreme environment.   [10]

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Option C — Extreme environments

The photograph shows a hot, arid landscape.

[Source: The American Southwest, www.americansouthwest.net]

a. (i) Identify any **one** landform shown in area A on the photograph. [4]

(ii) Suggest how landform B in the photograph was formed.

b. Explain **two** environmental impacts of tourism on **one named** extreme environment. [6]

c. Contrast the challenges for mineral extraction in periglacial environments and hot, arid environments. [10]

The photograph shows a feature formed by erosion in the Atacama Desert in Chile.

[Source: © International Baccalaureate Organization 2015]

a. (i) Outline the main erosional process that accounts for the feature shown in the photograph. [6]

(ii) Identify **and** explain the formation of **one** water-formed feature commonly found in a hot, arid environment.

b. Explain how **two** factors (other than heat) restrict human settlement in hot, arid environments. [4]

c. "Some human activities in extreme environments are more sustainable than others." Discuss this statement, with reference to **one or more** types of extreme environment. [10]

The two photographs show the Qori Kalis Glacier, Quelccaya Ice Cap, Peru. Photograph A was taken in summer 1978; photograph B was taken in summer 2002.
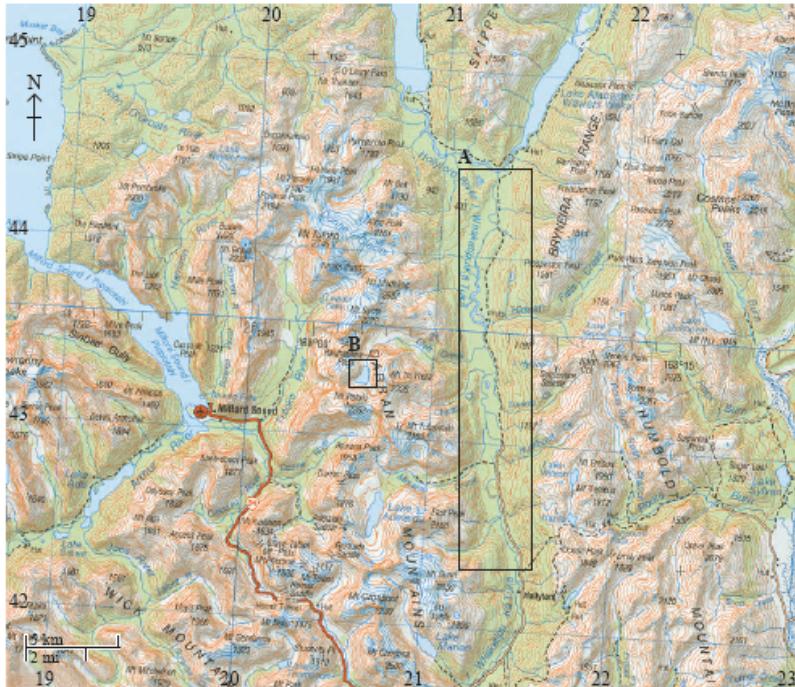
Photograph A (1978)

Photograph B (2002)
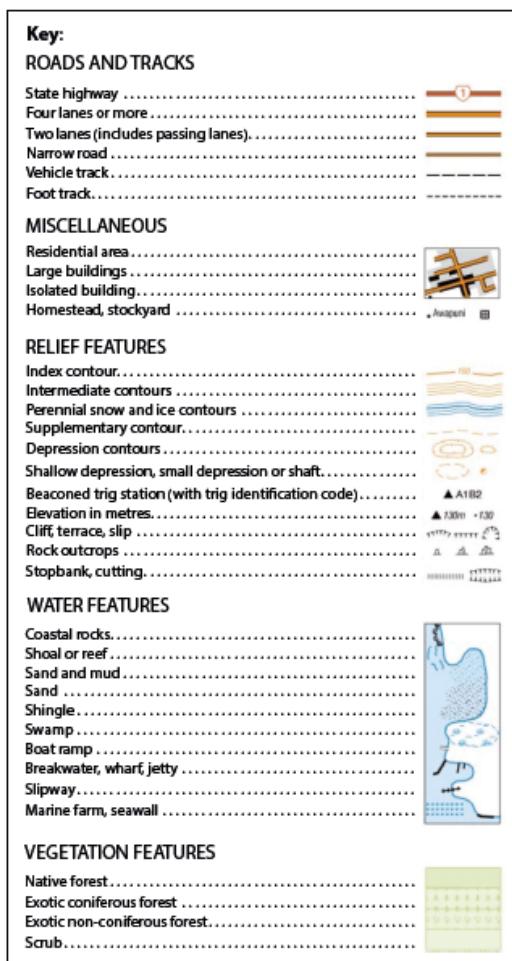

[Source: L Thompson, http://arizonaenergy.org]

a. Describe **two** changes in the landscape shown by the two photographs that demonstrate glacial retreat. [4]

b. Explain the formation of **two** features resulting from the processes of glacial and/or fluvioglacial deposition. [6]

c. Using examples, discuss the opportunities for agriculture in hot, arid areas. [10]

Optional Theme C — Extreme environments

5. The map extract shows a glaciated area of South Island, New Zealand. The scale of the map is 1:250 000. The contour interval is 100 m.

Key:

ROADS AND TRACKS

State highway
Four lanes or more
Two lanes (includes passing lanes)
Narrow road
Vehicle track
Foot track

MISCELLANEOUS

Residential area
Large buildings
Isolated building
Homestead, stockyard

RELIEF FEATURES

Index contour
Intermediate contours
Perennial snow and ice contours
Supplementary contour
Depression contours
Shallow depression, small depression or shaft
Beaconed trig station (with trig identification code)
Elevation in metres
Cliff, terrace, slip
Rock outcrops
Stopbank, cutting

WATER FEATURES

Coastal rocks
Shoal or reef
Sand and mud
Sand
Shingle
Swamp
Boat ramp
Breakwater, wharf, jetty
Slipway
Marine farm, seawall

VEGETATION FEATURES

Native forest
Exotic coniferous forest
Exotic non-coniferous forest
Scrub

a. (i) Identify **and** describe a landform of glacial erosion in area A on the map. [4]

(ii) Identify **and** describe a landform of glacial erosion in area B on the map.

b. Using map evidence, suggest **two** reasons why the area shown on the map has a low population density. [6]

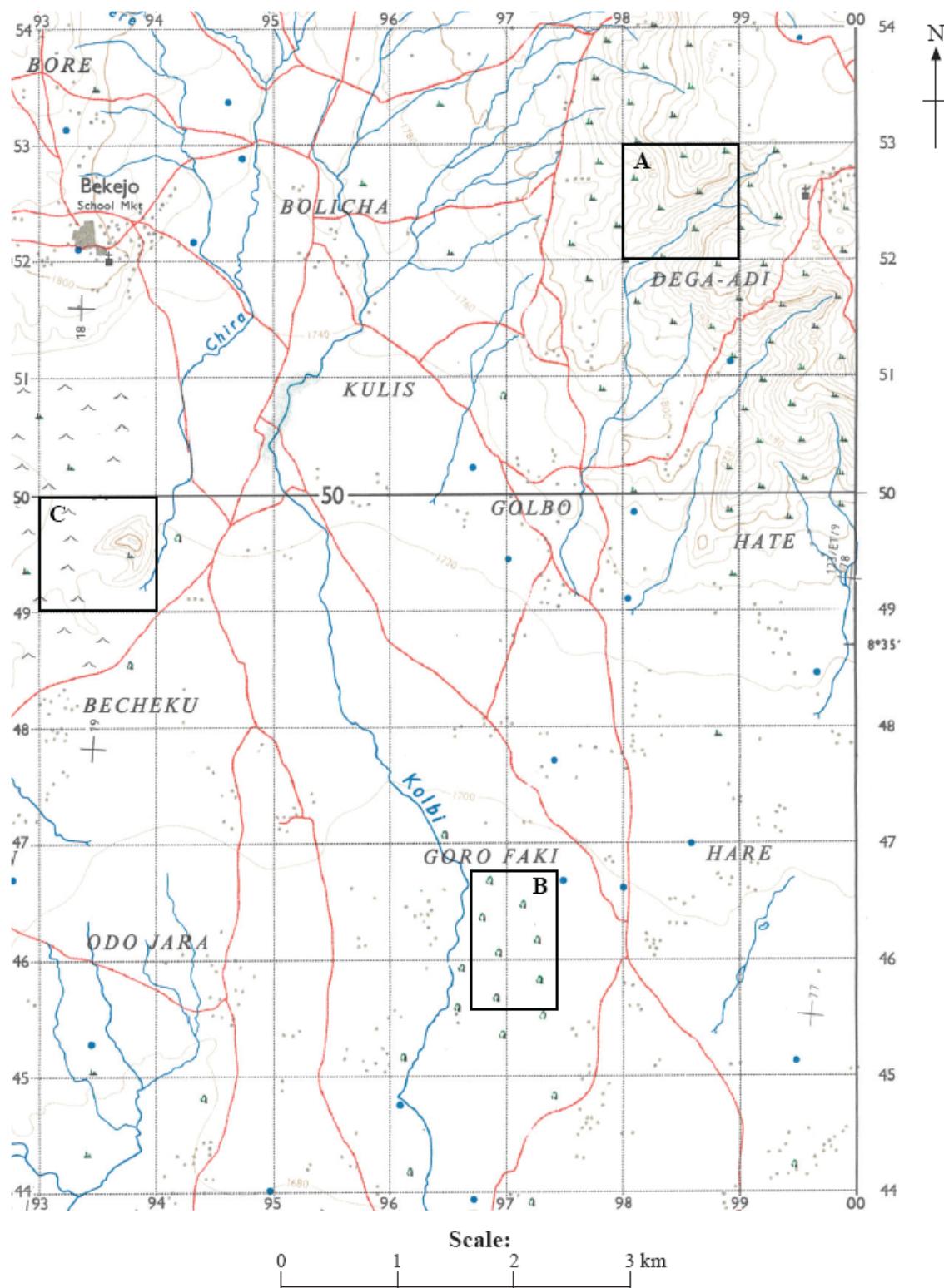c. "Mineral resources in extreme environments rarely bring benefits to the local people." Discuss this statement.   [10]

The photograph was taken at 68° North.
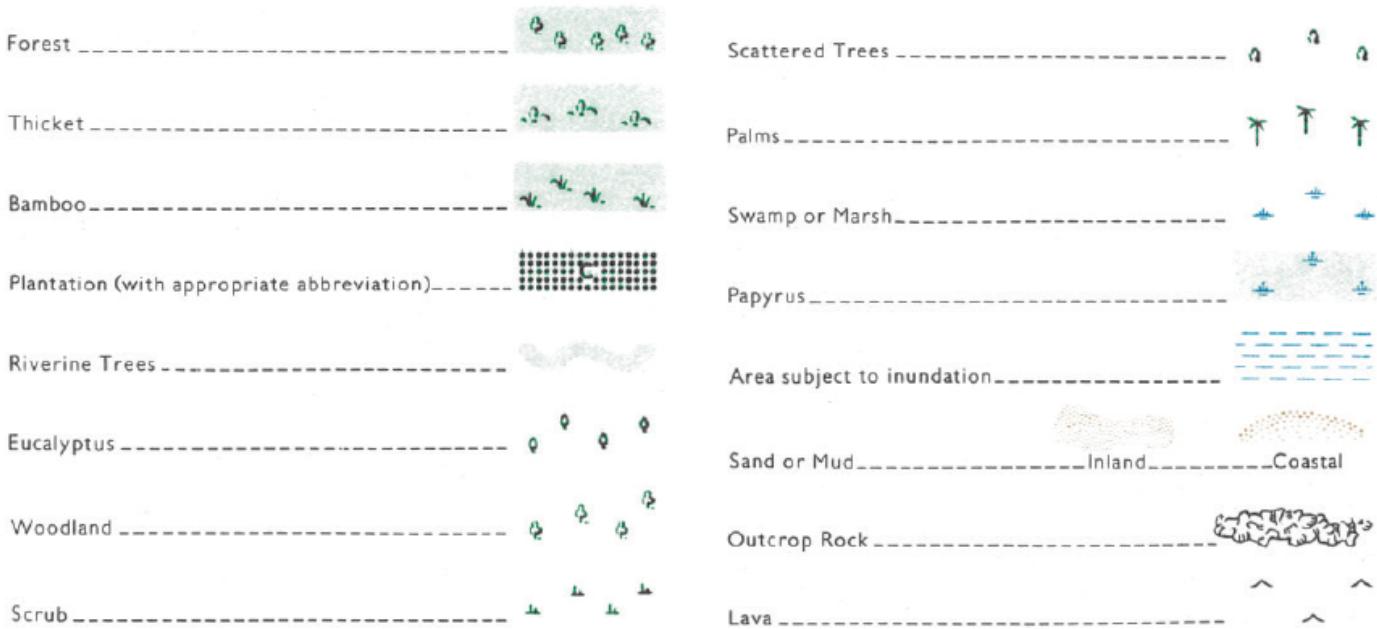

[Source: www.finnmark2007.com]

a. Referring to the photograph, briefly describe how people have adapted their clothing **and** transport in order to live in extreme cold   [4]

   environments.

b. Explain **two** causes of low rainfall in hot, arid environments.   [6]

c. Examine how tourism in **one** type of extreme environment has led to a wide range of adverse environmental impacts.   [10]

Key for map:

Town or area with permanent buildings including public buildings

Tukul Settlement

Tukul or other small building

Road : Asphalt Surface — 7 Road Number

· Loose Surface — Culvert Bridge

· Dry Weather, with Kilometre Stone — 30

Trail

Cut Line

Railway, Station, Level Crossing — Sta LC

· Light

Airport

Airfield (Asphalt)

Airstrip (Grass)

Telegraph or Telephone Line

" " " along Road or Trail

Power Line

Antiquity, Ruin

Site of Battle, Mineral Working

Mosque, Church

Boundary : International

· Kifle Hager

· Awraja

· Wereda

· National Park Reserve

Trigonometrical Station : Primary, Secondary, Other — △ ▽ ⊙

International Boundary Pillar — ▲ BP23/I

Spot Height (Surveyed) — ·1419

· " (Photogrammetric) — ·2256

Contours (V·I 20m) Depression — 2000 / 1980 / 1960

· Supplementary (V·I 10m)

Air Photo Principal Point with Film No — 123/ET/8 010

Watercourse, Waterfall, Rapids, Dam

· (Wide) : Waterfall, Rapids

· disappearing, indefinite

Well, Spring, Waterhole, Water Tank — OW OS ●WH ■WTk

Mill, Lighthouse

School, Hospital or Clinic

Cemetery : Christian, Moslem — ††† ʏ ʏ ʏ

Forest _____

Thicket _____

Bamboo _____

Plantation (with appropriate abbreviation) _____

Riverine Trees _____

Eucalyptus _____

Woodland _____

Scrub _____

Scattered Trees _____

Palms _____

Swamp or Marsh _____

Papyrus _____

Area subject to inundation _____

Sand or Mud _____ Inland _____ Coastal

Outcrop Rock _____

Lava _____

a(i). Identify the vegetation types found at A and B.   [2]

a(ii) Using the map extract and key, suggest **two** reasons why the area shown could be considered an extreme environment.   [4]

b. Briefly explain **two** weathering processes likely to operate in area C on the map.   [4]

c. For **one named** type of extreme environment, examine the impacts of tourism on the natural environment.   [10]