

0:01
the Blue Planet the Earth owes its name to water

0:07
it was in the oceans that life originated only water is found on Earth in three

0:13
states liquid solid and gaseous [Music]

0:21
water shapes landscapes deep Canyons cut into the Rock by

0:26
waterfalls and rivers as well as icy polar landscapes

0:33
hydrogen and oxygen combine to form H₂O water

0:40
one of the world's smallest molecules water is the essence of life but as

0:46
water is Mankind's most precious good 70 of the earth's surface is covered with liquid water

0:51
water makes our Earth unique virtually no other substance has been as

0:57
well researched yet still poses so many questions scientists worldwide are striving to

1:04
unlock the secrets of water [Music]

1:12
foreign

1:20
islands and countless coral reefs make up the Bahamas a natural landscape and

1:25
Island Paradise in the Atlantic [Music] here the sea is often only a few meters

1:32
deep [Music] but in many places behind the coral

1:39
reefs the seabed plunges steeply to a depth of up to four kilometers

1:47
great Abaco is one of the biggest islands in the north of the Bahamas the two marine biologists Tom Iliff and

1:55
Uli Kuntz are on their way to a mysterious location in its interior [Music]

2:04
just behind the pine forests on Abaco Island lies a hidden world [Music]

2:14
the entrance is well concealed and for good reason diving here is dangerous and

2:20
only trained cave divers are allowed into the water

2:26
thank you Ryan K cook probably knows the cave world of the Bahamas better than anyone

2:33
else he will guide the two Marine researchers on their expedition

2:38
I'm going into places that scientists have not normally gone so there's a

2:44
significant number of exploration cave divers who are going in

2:50
and studying these caves but very few of them are scientists so I want to go in I

2:56
want to see what this environment is like and what animals are living there

3:01
foreign leads into the underworld at first the

3:07
men dive through a layer of fresh water the lifeline is the diver's life

3:14
insurance only with its help will they be able to find their way back [Music]

3:26
and runs for hundreds of kilometers through large parts of the island world of the Bahamas

3:33
whole areas are still completely unexplored a challenge for scientists

3:47
the researchers have passed right through the fresh water layer down here they're swimming in pure sea

3:54
water [Music] stalactites thousands of years old form

3:59
a fascinating world of Their Own

4:07
progress is slow the men know that one wrong kick with their fins could destroy

4:12
the formations all these structures formed when the

4:19
caves were still dry in the course of time the most bizarre shapes emerged they're conserved by

4:26
clear water which is extremely low in oxygen

4:35

this is a time capsule fossils thousands of years old are found here again and

4:41

again [Music]

4:47

but how was such a unique Underwater World able to form at all

4:52

[Music] during the Ice Age glaciers spread

4:58

worldwide the sea level fell by up to 130 meters in the Bahamas too

5:05

foreign parts of the reef which forms the

5:11

Island's Bedrock dried out rain eroded cracks in the Limestone and

5:17

in the course of time an extensive cave network was created collapsed cave ceilings provide

5:24

entrances to the Underwater World towards the end of the Ice Age the sea level rose again flooding the caves and

5:30

creating the characteristic blue holes most blue holes have one thing in common

5:37

two aquatic worlds fresh water and sea water located one above the other

5:43

the fresh water here is like an iceberg we think of an iceberg floating out in

5:50

the ocean below our feet is a liquid Iceberg it's the fresh water and so being lighter it

5:59

floats on the heavier salt water underneath so there's basically an

6:06

extent of the ocean penetrating in and under every single island in the Bahamas

6:13

today there are vast numbers of these circular holes here many are interconnected Underground

6:20

[Music] here in Sawmill sync the researchers are swimming through a layer containing

6:26

toxic hydrogen sulfide a gas which in high concentrations is dangerous for

6:31

divers directly beneath is a magical divide

6:37

called a halocline fresh water lies above it and sea water which is heavier Lies Beneath it

What is meant by halocline?

6:45

The Divide seems paper thin yet it separates the two aquatic worlds perfectly

6:52

but why can't fish and other organisms Simply Swim through the halocline

6:58

well sea water is saltier than a fish and salt attracts water as a result the

7:03

fish constantly loses water through its skin so it has to drink but every mouthful of water also contains salt and

7:11

that has to be expelled again via the fish's gills a complex procedure [Music]

7:19

in contrast a fish living above the halocline is saltier than its environment so water permanently

7:25

threatens to flood its body it doesn't drink yet it still has to expel the water which penetrates through its skin

7:32

that's why the two will never meet even though they live in the same cave

7:44

in this confined space a laboratory of evolution has emerged [Music]

7:51

remipedes for instance are found only in a few places on our planet indeed these remarkable creatures were

7:58

not discovered until the late 1970s Tom Iliff is the expert on this animal group

8:06

remipedes live in salt water so they can only be brought to the surface through the freshwater layer in sealed tubes

8:18

foreign the Excursion into the Labyrinth of

8:25

caves is over [Music]

8:34

[Applause] [Music]

8:39

but the day's work isn't over for the scientists they want to examine their

8:45

valuable samples straight away remipedes look like centipedes but they

8:52

belong to the crustacean family they could even be a primeval form of crab

8:57

in their dark habitat during the course of evolution they have lost their eyes

9:02

[Music]

9:07

worldwide there are countless species of remipede Tom Iliff has been studying

9:12

these creatures for over 20 years are really intriguing animal their

9:19

Distribution on both sides of the Atlantic suggest that they've been living in caves since the formation of

9:27

the Atlantic and actually predate the extinction of the dinosaurs maybe if dinosaurs lived in caves they'd be

9:33

around too the tiny Crustaceans have been around from time immemorial but because of

9:41

their hidden way of life they were only discovered very late [Music]

9:46

the creatures are helping scientists to trace the Earth's development they are one of many pieces of the puzzle

Movement of tectonic plates

9:54

today the Atlantic is a huge ocean which separates continents the Earth's crust

9:59

is permanently moving something that can be observed particularly well in Iceland

10:07

this North Atlantic Island lies precisely on a fissure between two continental plates

10:14

here the Eurasian and the North American tectonic plates are forced apart

10:21

only in Iceland is it possible to dive between the continents glacier water fills the fissures

10:27

creating a special habitat and a unique diving location [Music]

10:35

with one hand in America so to speak and the other in Europe millions of years ago the whole Atlantic

10:42

was just such a fissure between the continents [Music]

10:50

the bowels of the earth enormous forces are at work permanently reshaping our planet

10:56

in the Atlantic they are causing the seabed to grow eruptions occur regularly

11:01

sculpting the mid-ocean ridge the biggest mountain range on Earth

11:06

more than sixty thousand kilometers in length it stretches right around the globe foreign

11:17

is part of this mountain range in the north of the island biologist olicons is

11:23

on his way to streaton a so-called white smoker a hydrothermal spring on the

11:28

seabed normally such vents only occur in the depths of the ocean but on Iceland they

11:35

can be found as little as 15 meters from the surface thus a totally separate

11:40

ecosystem has evolved [Music] foreign the vents are a window on the Earth's

11:47

interior minerals and hot water bubble up down here things are still the way they

11:53

must have been billions of years ago scientists suspect that at one time

11:58

hydrothermal Springs gave rise to life itself [Music]

12:07

conditions were ideal there was water and energy in the cracks and crevices of

12:13

the vents the building blocks of life were able to come together [Music]

12:20

at some time or other the first cell drifted out into the sea

12:27

the course of three billion years it resulted in the enormous diversity which

12:32

surrounds us today [Music]

12:40

and become extinct and even today no life can exist without water

12:46

but why is there water on Earth at all

How does water get to earth?

12:53

[Music] astronomers suspect that water was brought to the Earth billions of years

12:58

ago by meteorites our planet is struck regularly by meteorites even today

13:07
most of the impacts go unnoticed others hit the headlines
13:13
in 2013 a projectile from outer space exploded in the Ural in Russia
13:19
in 2016 researchers discovered a 30-ton meteorite in Argentina
13:24
and in Michigan in 2018 the sky was lit by a ball of fire caused by a meteorite

The Life of Whales

13:34
that some of these myriads have quite a bit of water uh you know to the tune of 20 of the mass of the rock is made up of
13:42
water with Clays and hydrated minerals and this material was certainly transported to the early Earth several
13:50
billion years ago and could have contributed a significant fraction of the Earth's water that we have today
13:57
[Music] in the early days of our solar system countless lumps of rock sailed through
14:02
space the young Earth too was exposed to a veritable bombardment
14:10
[Music] astrobiologist Daniel glavin believes
14:15
that fragments of meteorites contain messages from the early days of our solar system
14:21
he breaks down Cosmic rock into its components is it possible that not only water but
14:28
also the building blocks of life came to us from outer space foreign
14:33
[Music] Tes are actually very complex they
14:38
really hold in all the secrets from the early solar system where the water came from where the organic compounds came
14:45
from this meteorite I'm holding here in the test tube has over a hundred different amino acids a hundred life is
14:52
made up of 20. these are very chemically complex samples which makes it so
14:57
exciting it's it's actually the reason I love my job so much clear indications that water came to us
15:04
from outer space but not solid proof that's what NASA now hopes to provide in
15:10
September 2016 a rocket launched the sampling spacecraft osiris-rex
15:16
its destination the asteroid bennu a lump of rock measuring 500 meters across
15:23
osiris-rex's task is to take samples on bennu
15:29
the asteroid is also interesting for another reason its orbit will take bennu dangerously
15:35
close to the Earth but not for more than a hundred years the capsule with the samples from bennu is scheduled to
15:42
return to Earth in 2023 [Music]
15:48
this is a very ancient asteroid four and a half billion years old a frozen Time
15:55
Capsule a fossil from the early solar system and what I'm hoping to find out is when we have these samples back on
16:02
Earth is to understand for example how much water is in this asteroid how much
16:08
asteroids like bennu could have contributed to the oceans that we have on our Earth today and also whether or
16:14
not there are any building blocks of life I'm really excited about looking for those types of organic compounds and
16:21
and these materials but why is Water only found on the earth after all such projectiles also
16:28
hit other planets but Mercury for instance is located too close to the Sun
16:33
so any water evaporates at its equator conditions on Earth though are ideal
16:44
further out in space too on Mars the chances of water existing in liquid form
16:49
seem good three billion years ago there were torrential Rivers here
16:57
from the volcanic region in the South they flowed into a vast ocean in the
17:02
North over millions of years however most of
17:08
the water evaporated today Mars is Barren and empty
17:16

on the earth however life exploded around 10 million species live in the

17:22

world's oceans alone hidden in the depths are countless organisms we know hardly anything about

17:30

[Music] in the ocean some things are different

17:38

sounds for instance play a special role underwater

17:44

sound is as important for dolphins and other Marine creatures as light is for man

17:50

[Music] but for some time now there has been interference countless drilling rigs

17:57

ships sonar equipment and Military exercises produce a deafening noise

18:03

Around the Clock foreign

18:09

[Music] s in the world are spared at least to

18:17

some degree like the Cook Islands in the South Pacific it's here that the significance of

18:23

sounds underwater can be studied best [Music]

18:29

nanhauser is a whale researcher for 30 years now she's been observing whales

18:34

off the coast of Rarotonga and studying the behavior and communication patterns of these marine mammals

18:41

[Music] humped back whales

18:49

[Music]

18:58

every year the period from July to September is whale season in the South Pacific

19:04

the animals spend several months in the warm water mating and rearing their young [Music]

19:17

during this time humped-backed whales don't feed they live solely from their

19:22

fat Reserves using a hydrophone an underwater

19:28

microphone Nan can even detect whales a considerable distance away

19:40

we got a singer [Music]

19:47

male humped back whales sometimes sing for hours on end

19:53

you know

19:59

scientists still have only a partial understanding of whale songs

20:09

[Music]

20:17

good morning the songs are made up of several verses and each whale population

20:22

sings a slightly different Melody is this enables researchers to determine

20:27

which region a whale comes from it seems however that the different songs are mixed

20:33

in Rarotonga Nan records new songs time and again

20:40

we have recorded Wales that are teaching other Wills

20:46

the song which is fascinating and sometimes we'll have a song and we think that's the song

20:53

for the Cook Islands for the season and then another whale will come in and it will sing another song

20:59

a totally different song and then a few days later the whales here will have

21:05

Incorporated a phrase of that song into their song

21:12

during the whale season Nan spends many hours each day on the water nevertheless as a rule only brief

21:20

observations from the boat are possible

21:27

diving into their habitat is far more rewarding but it has to be done without

21:32

breathing equipment because the noise would irritate the animals [Music]

21:44

the whales tolerate free divers near them this makes unique observations possible

21:50

but only for a short time on average humpback whales spend 20

21:56 minutes in the depths impossible for a diver without oxygen tank
22:02 foreign
22:07 [Music]
22:14 consequently marine biologists are also dependent on indirect clues for their
22:19 research for instance as the animals surge through the water flaps of skin are left
22:24 behind
22:32 fernan Hauser such scraps are a source of important information
22:37 they are a kind of whale fingerprint [Music]
22:48 these were cleared it's from um we're trying to figure out how to use the end of the DNA stand where the
22:55 telomere is to to age the animal we look at blue carbon stable isotopes microbiology but everything just from a
23:02 little piece of skin pretty cool [Music]
23:07 after The Mating Season the whales set off on the great journey to the Antarctic
23:12 foreign like the water itself marine organisms
23:18 are also constantly in motion some migrate of their own accord others are
23:24 carried by the current Krill in the Antarctic these tiny
23:29 Crustaceans form gigantic Shoals and they attract humpbacked whales
23:34 every year the whales travel more than ten thousand kilometers to and fro between their winter and summer quarters
23:41 [Music] the big ocean currents distribute warmth
23:47 food and energy and thus control all life in the seas

What causes ocean currents?

23:55 at the Equator the sun heats up the ocean the warm water drifts to the poles where
24:02 it cools and sinks Into the Depths [Music]
24:08 it flows back as a deep current and the cycle Can Begin Again
24:17 [Music] wherever the ocean currents transport nutrients to the surface life
24:23 concentrates this movement is driven by salt and temperature differences
24:30 we're talking about a global conveyor belt but we still don't know precisely how it functions or how for example it
24:37 reacts to changes in the water temperature
24:47 now an international research team plans to solve the riddle
24:53 aircraft airships and numerous research vessels they are staging a very special search
25:01 today they are focusing on an area of the Baltic Sea Southwest of the Danish island of bornholm
25:09 from the air the researchers can scan the surface of the water because what they're looking for is transient
25:16 the emphasis is not on the major ocean currents but on small Eddies
25:21 they were only discovered a few years ago and scientists suspect that they play a major role with regard to Main
25:28 coherences in the ocean Expedition leader borka bashek wants to
25:33 determine the connection between small Eddies and major currents we've worked for years to put us in a
25:41 position where today we can go out and Survey Eddies we've invested so much effort and are
25:47 really excited naturally we'll try to get the very best results we've prepared everything as
25:53 best we could so we're absolutely delighted
25:58 satellite pictures have helped us gain a better understanding of our Blue Planet the major ocean currents are also
26:05

clearly visible from space for a long time though small Eddies could not be detected

26:13

it's only Now by combining various technologies that researchers have

26:18

managed to study these currents more closely and they are astonished at how often small Eddies occur in the ocean

26:28

range in diameter from 100 meters to three or four kilometers so they're relatively small in comparison with the

26:35

other ocean currents and they're found worldwide their special feature is that they're short-lived some exist for as

26:41

little as 12 hours they rotate very quickly and dissipate just as fast so we have to be quick to measure them

26:48

first of all in the early morning the motor glider surveys the research Zone in the Baltic its task is to locate

26:56

Eddies the Airship also scans the surface with

27:01

special cameras Orcutt bashek coordinates the search

27:06

the Airship has one decisive Advantage for the researchers if something interesting has been discovered it can

27:13

park for hours over the water and enable the surface to be surveyed in detail

27:22

here's the Airship we found an Eddy the decisive signal bashek gives the

27:29

coordinates through to the research ships the structure in the water can even be

27:35

seen with the naked eye

27:40

a distinct front runs right across the surface so where does this structure come from

27:50

crew on board the research vessel are lowering the troll as it's known into the water

27:56

the device is packed with sensors which provide data on the density and the oxygen content of the water

28:05

in the water the troll Bobs up and down since the Eddy is constantly changing

28:10

and moving the measuring equipment also has to be mobile

28:18

the data are transmitted immediately to the Airship where a thermal image shows what's happening in the water

28:30

the current transports cold water from below up to the surface enormous energies are at play here

28:41

the great thing is that for the first time ever we were able to observe an Eddy from its formation to its

28:47

dissipation so today we've achieved a totally new level of data accuracy

28:55

the Eddies are of decisive importance to life in the ocean because along with the cold water nutrients are brought up from

29:02

the depths comprising a broad range of tiny algae unicellular creatures and bacteria

29:08

they're a launch pad for life

29:14

major ocean currents and small Eddies are a heat pump for our planet

29:19

and they also influence conditions on land it's thanks to the Gulf Stream that Lush

29:24

forests grow in our latitudes [Music]

How do trees absorb nutrients?

29:29

deciduous forests need a moderate climate water

29:34

all trees have the same problem even if they're standing in water the

29:40

water still has to be transported from The Roots up to the leaves [Music]

29:48

with a beech tree that can mean a good 40 meters

29:54

it all begins in the ground if the roots are drier than the surrounding earth water penetrates

30:01

automatically water and nutrients are taken into the

30:08

interior of the tree via countless thin root hairs it's at this point already that some

30:13

pollutants are broken down the water then diffuses further into the

30:21

tree's xylem condits it's then transported up in these highly

30:28

specialized Pipelines Beech trees achieve a speed of up to six meters an hour

30:34
the water is sucked up by capillary action because in narrow tubes liquids rise
30:40
automatically but that is still not enough to transport water to the treetop
30:46
this takes place by means of transpiration pull [Music]
30:54
every molecule that escapes into the air draws a new molecule from the soil
30:59
in this way there is a constant flow of water through every tree
31:05
a highly effective pump Forest creates its own moist climate
31:15
here one in every three raindrops becomes drinking water but most of the water rises up again via
31:23
the trees evaporates and forms clouds
31:29
they look as light as a feather but faux weather clouds known as cumulus can easily be one cubic kilometer in
31:37
size and weigh thousands of tons as much as five houses [Music]
31:48
the more water a cloud contains the heavier it gets until eventually rain
31:53
falls foreign of precipitation on Earth is distributed
32:01
most unevenly and determines whether a region enjoys abundant growth or suffers
32:07
from drought the clouds contain only a fraction of

How clouds are formed

32:12
our fresh water reserves but what determines whether clouds simply dissipate or rain actually falls
32:23
Everhart bordenchatz wants to find out he's devoted his entire life as a
32:28
researcher to clouds in order to study them he plays regular visits to Germany's highest mountain the
32:34
torgspitzer located at an altitude of 2 600 meters the schneffiana house a
32:41
former hotel is Germany's highest research station it's an ideal place for
32:46
cloud research [Music] I simply want to understand exactly how
32:52
rain is formed we all know that rain does fall and we also know a great deal
32:57
about it but can we really predict from the Dynamics when it will rain how a
33:02
cloud develops basic questions present themselves can I
33:07
improve weather forecasting can I say when it will rain can I produce a weather report that is reliable for
33:14
longer periods not just for a day but also for a week can I forecast the climate
33:21
the two researchers are on the lookout for clouds what they're interested in takes place
33:27
constantly in every cloud invisible however to the human eye
33:34
tiny droplets of water are driven to and fro they evaporate Collide and sometimes
33:41
grow to form raindrops [Music] for that to happen droplets need to
33:49
collide droplets have to find one another that's a nice way of putting it so droplets have to find one another not
33:55
just two but millions of them in order to form one raindrop that is how rain forms
34:03
the researchers will observe this process they want to see how raindrops
34:08
form in a cloud so far no one has managed that what they plan is only
34:13
possible with the help of state-of-the-art Technology but the clouds also have to play along
34:19
in the late evening the conditions are ideal okay we'll run the motors now
34:27
hey young okay releasing in three two
34:35
one release a powerful laser makes the tiny droplets
34:40
visible the equipment functions like a gigantic flash gun evaluation is still underway but the
34:48

data will probably provide the answer to one of the greatest mysteries of cloud research

34:54

[Music] and um someone who understands how rain forms

35:00

could in a subsequent step try to influence the weather

35:05

this land is the country which gets the first cloud has the first claim on it just imagine if we were able to make our

35:11

clouds produce rain or not because that's just as important let's say that our Farmers want to bring

35:18

in the Harvest so all the clouds are sent to Poland causing massive downpours there and that's what scares me the idea

35:26

of us focusing not on water on the ground but on watering clouds and water is Mankind's most precious good

35:37

water is the elixir of life without water in its liquid form Life as we know

35:43

it would be inconceivable we drink it and it serves as a habitat

35:48

around half of all species of fish live in fresh water [Music]

35:57

we are all more than familiar with the properties of water yet H₂O often behaves differently from

36:04

any other substance for example when it freezes

36:11

when a lake Freezes Over the ice floats on the surface so we have the solid form of water on

Why floats ice on water?

36:18

top and the liquid form underneath the reason why ice is lighter than water

36:23

is because water has its maximum density as a liquid

36:29

that is a curious property but it explains why life is able to exist under the ice

36:34

the layer of ice acts as an insulation and prevents the water beneath it from freezing

36:39

[Music] in Lake Baikal even a species of seal is

36:44

able to survive under the ice it's the only seal that occurs solely in

36:49

fresh water beneath the ice life continues even

36:56

though in Winter Lake Baikal is Frozen for months on end

37:02

scientists have been studying the characteristics of water for centuries and they're surprised time and time

37:08

again probably the most mysterious water in

37:13

the world lies hidden in South Africa [Music]

37:20

The more I've got song mine is one of the biggest in the country it has served as a source of uranium and

37:27

gold for more than a hundred years outdated and modern technology often

37:32

collide accidents occur here time and again

37:38

it's not gold that Errol Cason and his team are interested in they are looking for water

37:44

that is millions perhaps even billions of years old [Music]

37:51

this is the fastest and longest mine lift in the world [Music]

37:56

the final station is more than three kilometers Underground the deeper the men go the hotter it gets

38:10

the mine cage hurtles down at a speed of almost 70 kilometers an hour

38:16

[Music] we're hoping that we'll find some water

38:21

down there they're getting pretty close to the fracture zone now so this is now the

38:28

best chance that we'll actually find water uh in the in that cavity down there but today they still have about 20

38:36

meters left to do before he actually hits where the fracture was with the previous holes so anything can happen

38:48

foreign if it weren't for gold mining the researchers would never have been able

38:54

to explore this extreme and inhospitable region spreading out far below the surface here

39:00

is virtually a medium-sized town

39:06
the researchers travel on by Mine Train the drilling site has been carefully
39:11
chosen because only a few years ago the earth shook here
39:16
the scientists want to drill precisely into the fault Zone they suspect that somehow there is a
39:22
link between the earthquake water and microbes that live underground
39:30
rock this old is only found in a few places on Earth and hardly anywhere is it accessible to
39:36
scientists the or mind here formed deep in the bowels of the earth nearly three billion
39:43
years ago can life really exist under such conditions
39:48
traces of water are at least a crucial prerequisite
39:53
[Music] worth drilling four kilometers below surface and from a microbiology
40:01
standpoint this has also not been done a lot in the past so as we're going deeper
40:06
and deeper under the surface the water becomes hotter water becomes older and any microorganisms that we might find
40:12
might be more unique more novel or anything that we haven't seen before
40:18
cooling water is escaping everywhere it's essential to make sure it doesn't contaminate the samples
40:29
if the scientist's calculations are correct they are very close to The Fault which cause the earthquake
40:35
this is something they've worked towards for many months
40:41
one core drill after another is removed from the Rock if the samples really do contain life it
40:47
must be able to cope with the most extreme conditions heat and radiation immense pressure and eternal darkness no
40:55
oxygen and virtually no nutrients
41:01
foreign but life finds the most astonishing Solutions

Life in caves

41:08
some of the microorganisms down here in the subsurface might take even a thousand years to go from one cell to
41:15
two cells and this is only one of the ways that they have managed to survive down here [Music]
41:21
back in the laboratory biologist Errol Cason gets straight down to work
41:26
he is specialized in finding creatures in the most impossible places he expects
41:32
to discover microbes which are minute unicellular organisms
41:37
but he finds something far bigger remarkable worms around half a millimeter in size huge in comparison to
41:45
protozoa it's living it's breeding how amazing it
41:53
is that life can actually occur and survive in really weird circumstances
41:59
that has definitely changed my perspective regarding what is possible
42:05
and what we've previously thought is impossible it would apparently appear that nothing is impossible when life is
42:11
concerned organisms which inhabit The Depths live in slow motion but all around them
42:17
Evolution continued for a long time life only existed in water but at some point
42:24
it took its first step onto land
42:31
the tectalik was a fish that walked on fins that was nearly 400 million years
42:36
ago but since then life has conquered every corner of the globe
42:42
whether we're talking about tropical rainforests or inhospitable deserts the
42:47
sole prerequisite for life is the presence of water
42:55
there is life in the Eternal ice of the Antarctic just as there is in the polar
43:00
regions of the North a large proportion of the Earth's fresh water reserves are frozen solid at the
43:07

poles scientists at the Polish research station on spitzbergen are studying the

43:13

Arctic global warming is having a particular impact on this region

43:19

when the men are out and about they always carry a gun not because of the arctic foxes but on account of the polar

43:27

bears whose Trails lead right past their station [Music]

43:34

the landscape here is amazing the northern lights are visible right through to Spring

How is polar light formed?

43:43

the scientists are preparing for a very special Expedition they are going to descend into a glacier and examine its

43:50

heart so to speak from the inside it's very important to understand how

43:58

the water behave inside the glacier because this affect all the dynamic of the glacier and up to now

44:04

it's a kind of black magic box and we only have theory about what is going on inside and the only way to verify the

44:12

theory and to really known actually really what's going on inside is to go

44:18

inside the scale system the men set off in the early morning

44:24

the destination the handspring Glacier is only about two kilometers away

44:30

the landscape of snow and ice they travel through consists of Frozen fresh water

44:36

[Music]

44:42

but when the ice masses here melt they flow into the ocean and cause the sea level to rise

44:48

consequently the cycle of salt water and seawater is extremely coherent

44:53

[Music]

45:00

last Autumn Leo de Co marked the entrance to the glacier with a metal pole

45:05

since then a lot of new snow has fallen even so beneath it there must be a way

45:12

in so the men have to dig [Music]

45:26

success the team have found the glacial Mill or Muller a natural entrance to the

45:32

glacier [Music]

45:45

the men descend meter by meter little by little the shaft has been carved out of

45:50

the Ice by melt water and Rock the ice crystals consist of H2O frozen

45:58

water molecules and yet each crystal is unique because the structural

46:03

possibilities for its composition are infinite [Music]

46:13

the men are well secured it can mean the difference between life and death

46:18

especially here in the upper region of the glacier where the ice is younger and contains lots of air

46:27

the team now absile for a good 70 meters at regular intervals Leo installs a

46:34

sensor in the ice to record the pressure and temperature as well as the movement of the glacier

46:43

the measuring devices will remain here for the next few months Leo will not be able to return and

46:49

evaluate the results until next autumn

46:54

do you hear that just be quiet for a second listen

47:00

yeah that's water this is the water yeah that's beautiful [Music]

47:09

if it were a little later in the year the men could be surprised at any time in these passages by a river of melt

47:15

water in summer water surges Into the Depths here

47:22

it's only in Spring and Autumn that the researchers are able to advance so far into the glacier

47:27

the weather conditions are right and the ice has the right solidity

47:33

[Music]

47:41
the men have finally reached the base of the glacier they've been on the go now for a good

47:47
six hours towering up all around them are millions of tons of ice

47:56
in several stages they've covered a difference in height of over 200 meters

48:05
the glacier doesn't lie on the Bedrock between the glacier soul and the rock is

48:10
a narrow passage in some places it's big enough to walk in others it's only a few centimeters

48:18
high

48:24
[Music] the ice might look stable but the glacier is constantly moving

48:35
actually the fact that we have this water flowing that we can hear right now it's just coming and lubricate this

48:43
interface between the bottom of the glacier and the bedrock and the fact that the glacier is not lying anymore on

48:50
the Rock which is like very hard to move on it but it's actually on the water so

48:57
it's very easy to slide and the more water you will have at this interface

49:02
ice and rocks the fastest the glacier will go

49:08
from the outside the glacier looks like a compact ice Mass but in reality it's

49:14
permeated by hulls and channels the Melt water Cuts tunnels in the ice

49:21
in summer in particular water plunges into the depths through these mullans as they are known

49:28
the water collects at the base and the whole Glacier slides towards the sea as

49:33
if it were on a film of lubricant on the coast huge ice masses then Shear

49:39
off and cause the sea level to rise

49:48
Leo wants to measure this glacial movement with his sensors exactly where it takes place

49:54
[Music]

50:00
so far scientists know astonishingly little about processes deep in the

50:05
interior of a glacier

50:10
hot Steam and Ice are a dangerous mix but Leo wants to fix his sensor as

50:16
securely as possible it's the only way of ensuring he'll be able to find it again in several months

50:22
time [Music]

50:27
the data will enable him to determine how much water has flowed through in the summer months

50:33
by piece the researchers are putting a picture together which they hope will answer important questions

50:39
how quickly are the glaciers melting and what consequences will this have for the

50:45
entire ecosystem in the Arctic the glacier extends as far as the coast

50:52
here it's only a few meters thick

50:59
a strenuous and dangerous Expedition has come to an end

51:07
it will take years to evaluate the findings

51:12
foreign oceans rivers and clouds are all part of

51:20
the Eternal water cycle and all life depends on water

51:26
[Music]

51:44
foreign [Music]