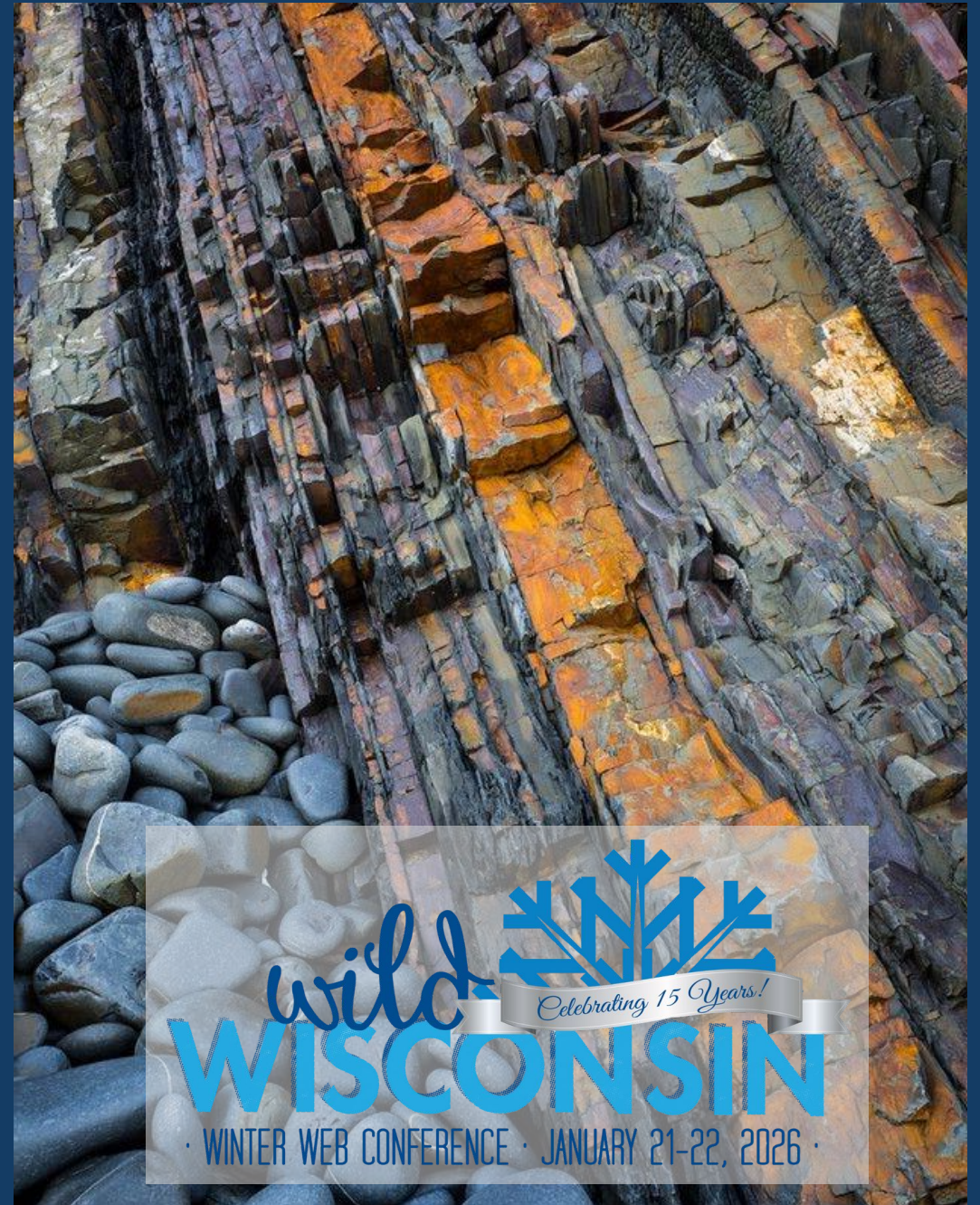


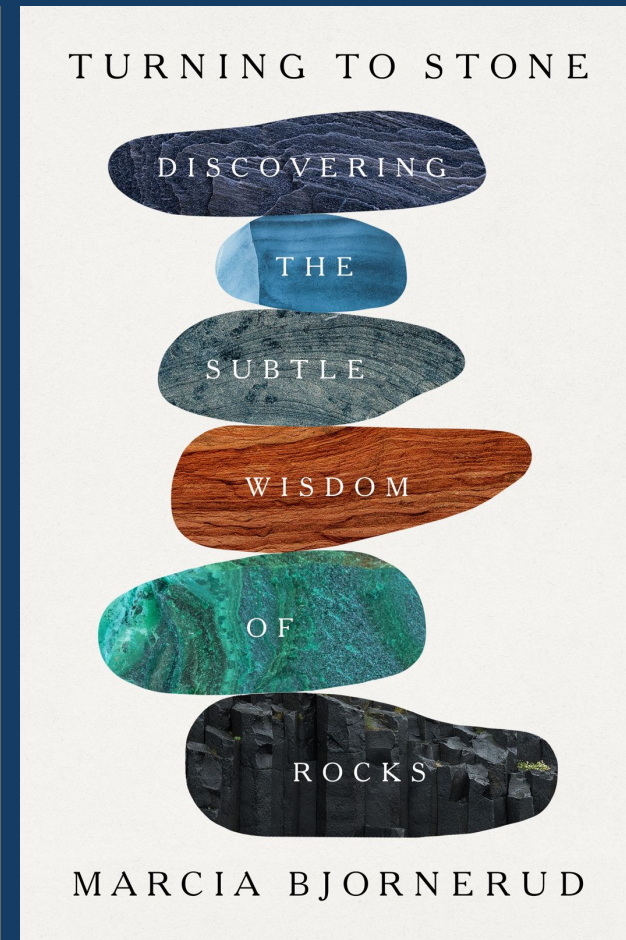
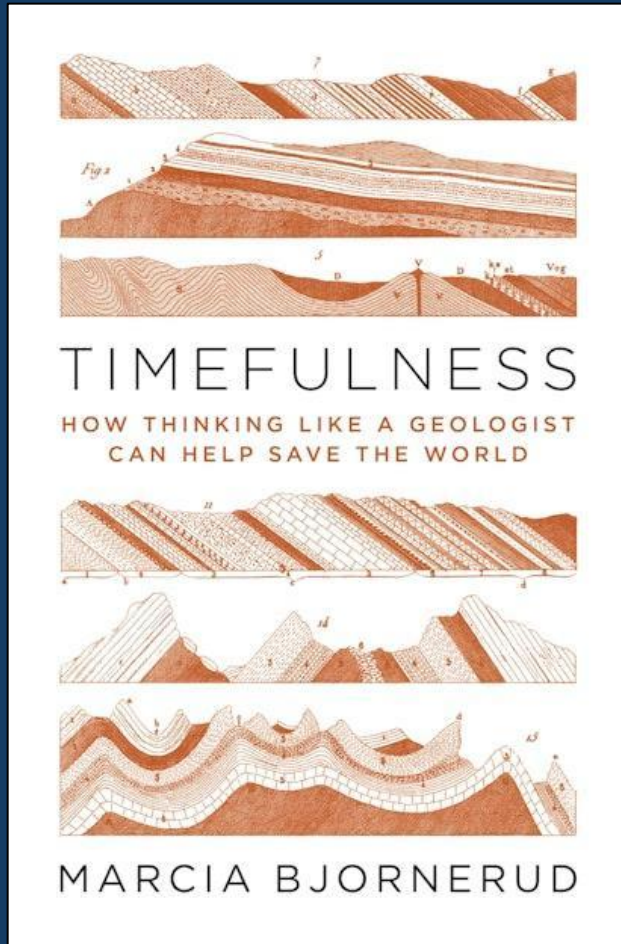
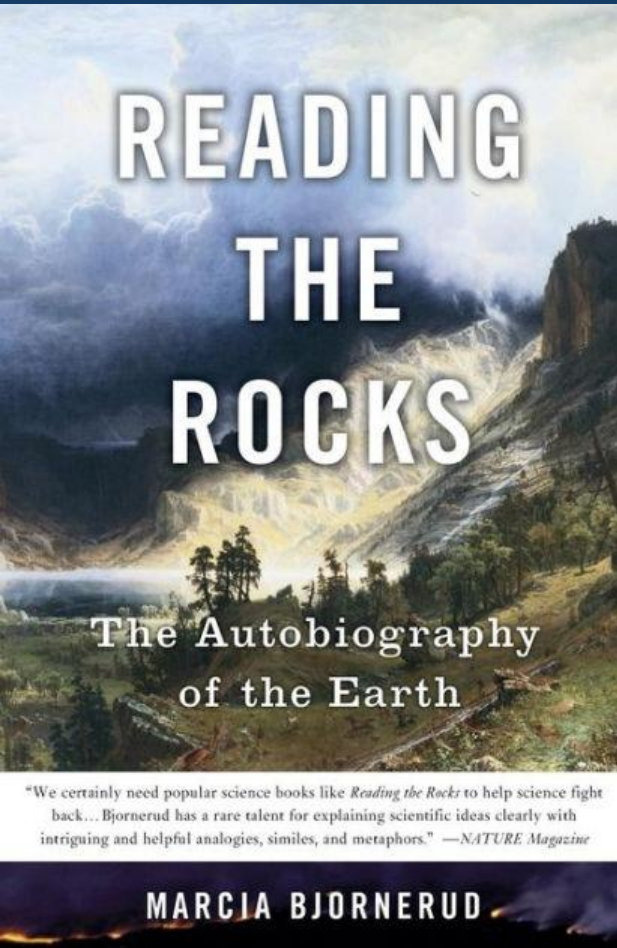
Reading the world around us: Rocks as libraries

Marcia Bjornerud
Professor of Geosciences, Lawrence University





Mabel Tainter Memorial, Menomonie, WI



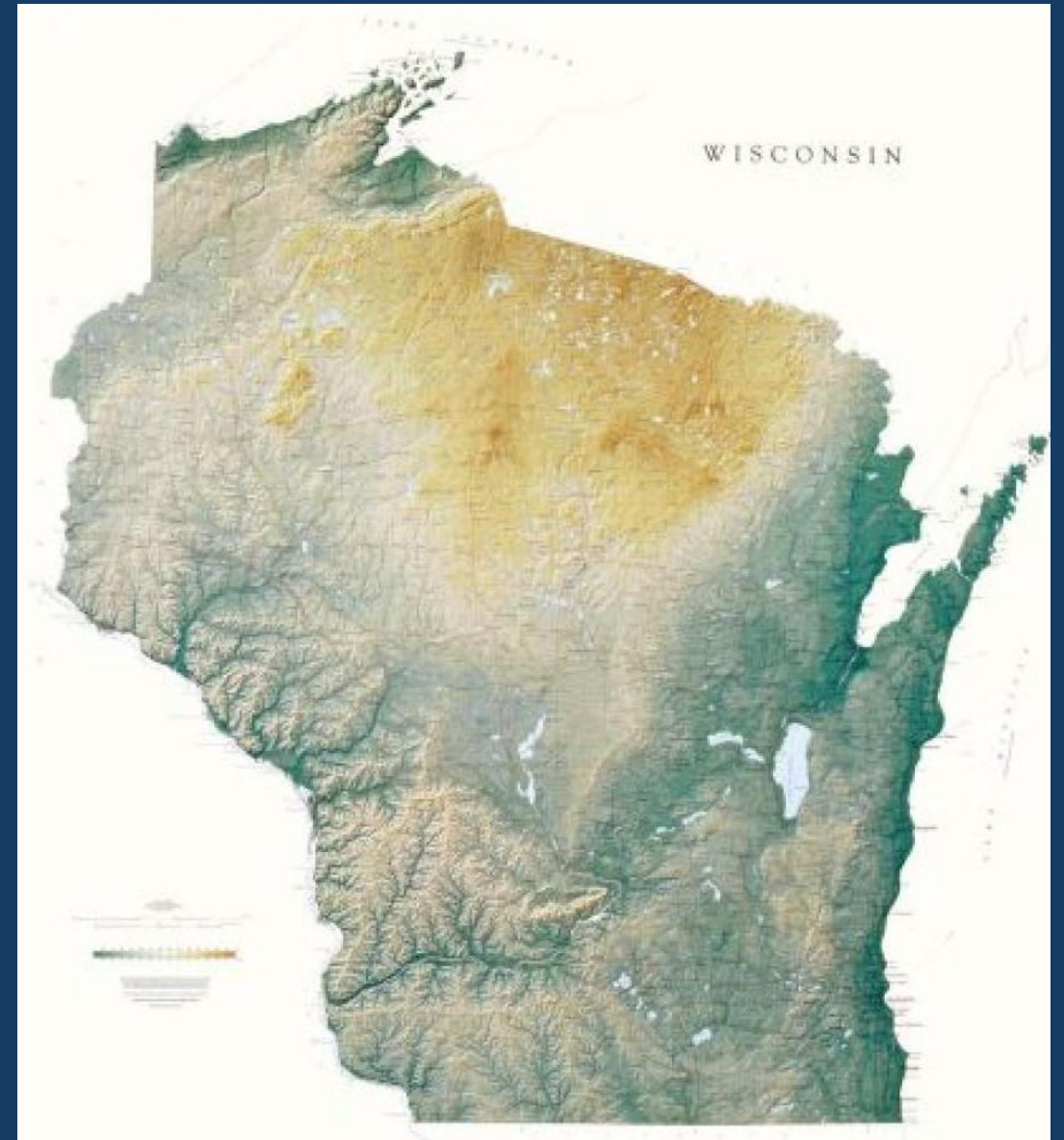


Surtsey, Iceland 1963

A photograph of a meteor streaking across a dark, star-filled night sky. The meteor is a bright, white-to-yellowish line with a glowing blue-white head, moving from the lower-left towards the upper-right. The background is a dense field of small, distant stars, with a faint, hazy band of light visible in the upper right corner, possibly representing a galaxy or nebula.

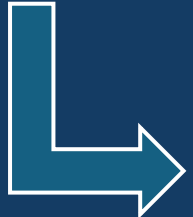
Dis - aster
Bad star

Landscapes as *palimpsest* texts



1 H Hydrogen																	2 He Helium																														
3 Li Lithium	4 Be Beryllium											5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon																														
11 Na Sodium	12 Mg Magnesium											13 Al Aluminum	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Argon																														
19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium	32 Ge Germanium	33 As Arsenic	34 Se Selenium	35 Br Bromine	36 Kr Krypton																														
37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon																														
55 Cs Cesium	56 Ba Barium	57-71 Lanthanides	72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium	78 Pt Platinum	79 Au Gold	80 Hg Mercury	81 Tl Thallium	82 Pb Lead	83 Bi Bismuth	84 Po Polonium	85 At Astatine	86 Rn Radon																														
87 Fr Francium	88 Ra Radium	89-103 Actinides	104 Rf Rutherfordium	105 Db Dubnium	106 Sg Seaborgium	107 Bh Bohrium	108 Hs Hassium	109 Mt Meitnerium	110 Ds Darmstadtium	111 Rg Roentgenium	112 Cn Copernicium	113 Nh Nihonium	114 Fl Flerovium	115 Mc Moscovium	116 Lv Livermorium	117 Ts Tennessine	118 Og Oganesson																														
<table border="1"> <tr> <td>57 La Lanthanum</td> <td>58 Ce Cerium</td> <td>59 Pr Praseodymium</td> <td>60 Nd Neodymium</td> <td>61 Pm Promethium</td> <td>62 Sm Samarium</td> <td>63 Eu Europium</td> <td>64 Gd Gadolinium</td> <td>65 Tb Terbium</td> <td>66 Dy Dysprosium</td> <td>67 Ho Holmium</td> <td>68 Er Erbium</td> <td>69 Tm Thulium</td> <td>70 Yb Ytterbium</td> <td>71 Lu Lutetium</td> </tr> <tr> <td>89 Ac Actinium</td> <td>90 Th Thorium</td> <td>91 Pa Protactinium</td> <td>92 U Uranium</td> <td>93 Np Neptunium</td> <td>94 Pu Plutonium</td> <td>95 Am Americium</td> <td>96 Cm Curium</td> <td>97 Bk Berkelium</td> <td>98 Cf Californium</td> <td>99 Es Einsteinium</td> <td>100 Fm Fermium</td> <td>101 Md Mendelevium</td> <td>102 No Nobelium</td> <td>103 Lr Lawrencium</td> </tr> </table>																		57 La Lanthanum	58 Ce Cerium	59 Pr Praseodymium	60 Nd Neodymium	61 Pm Promethium	62 Sm Samarium	63 Eu Europium	64 Gd Gadolinium	65 Tb Terbium	66 Dy Dysprosium	67 Ho Holmium	68 Er Erbium	69 Tm Thulium	70 Yb Ytterbium	71 Lu Lutetium	89 Ac Actinium	90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium
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Elements =
Alphabet



Minerals =
Words



Rocks =
Sentences

The moon has only about
300 minerals
and a half dozen rock types



Earth has more than
6000 minerals and
hundreds of rock types

If minerals are words,
Earth has a large vocabulary.

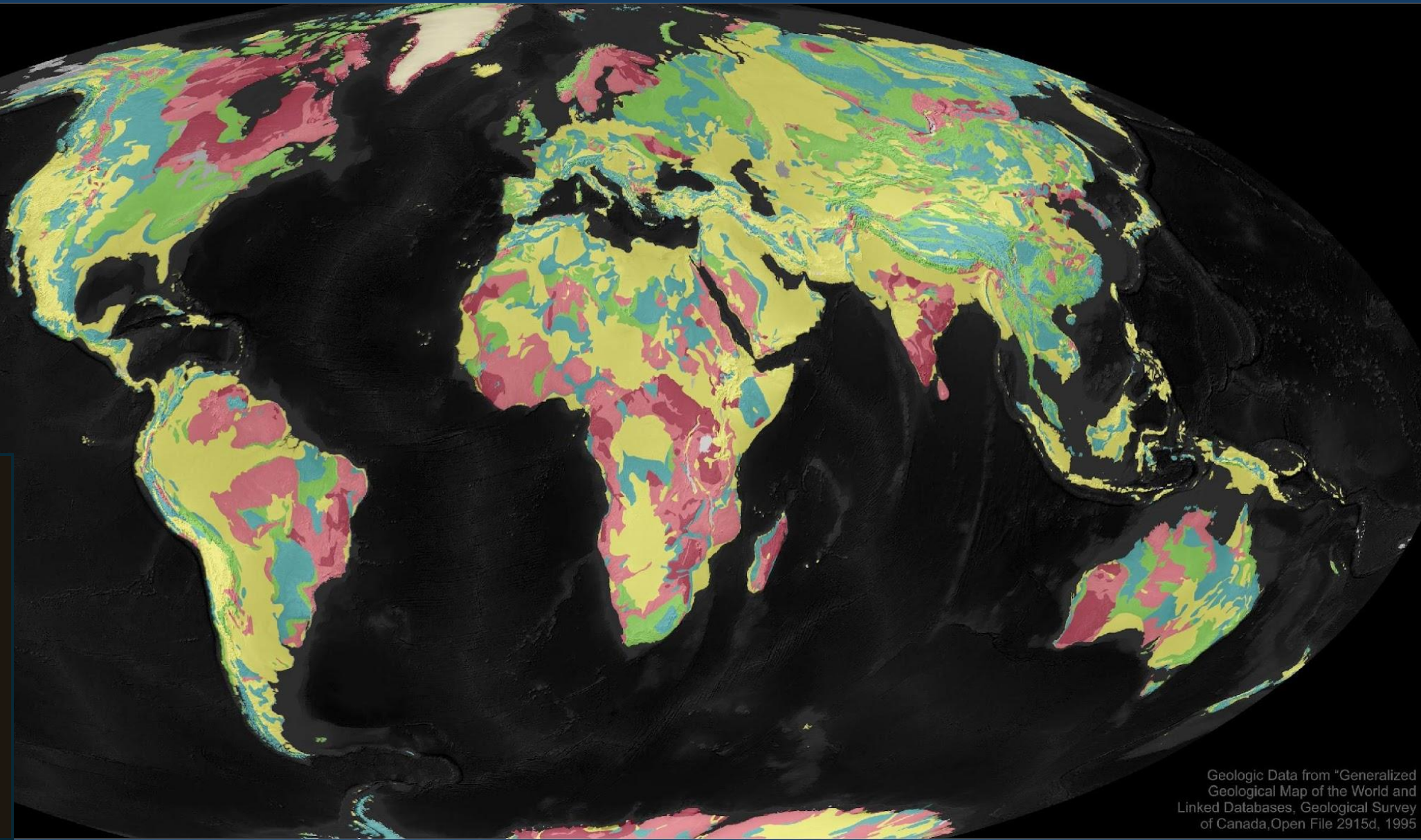
If rocks are sentences,
Earth has lots to say!

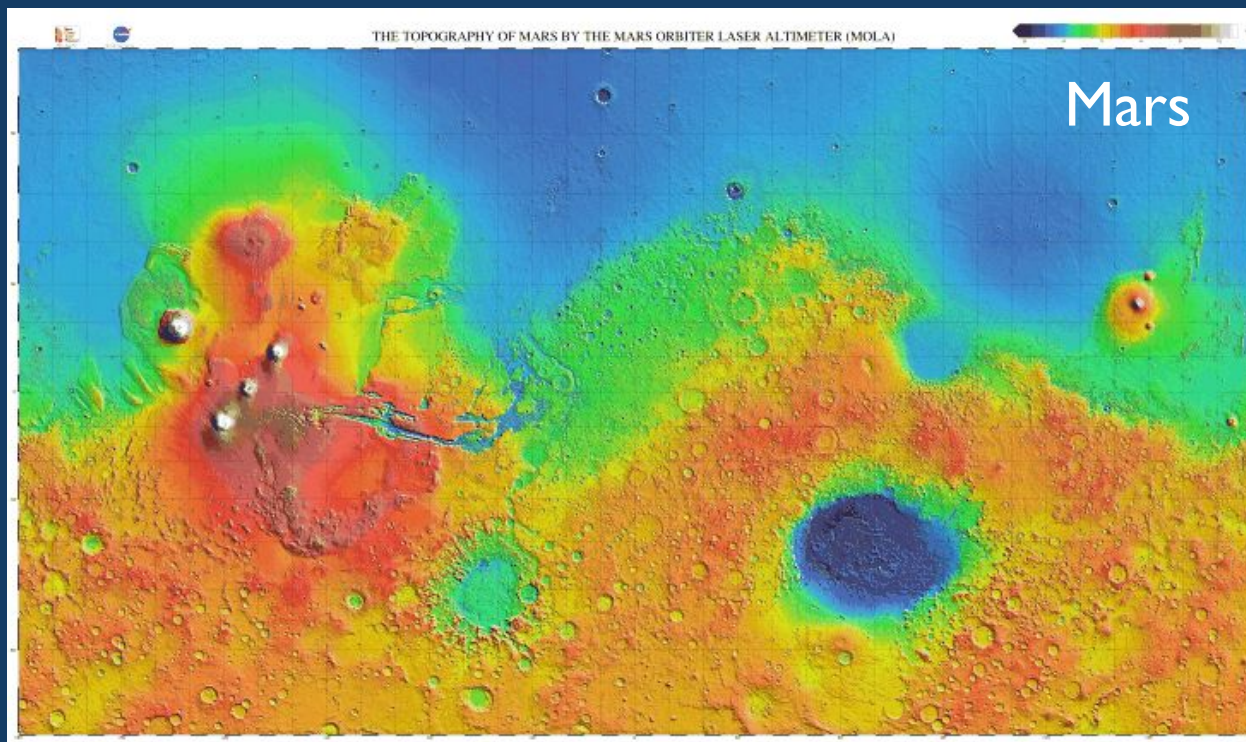
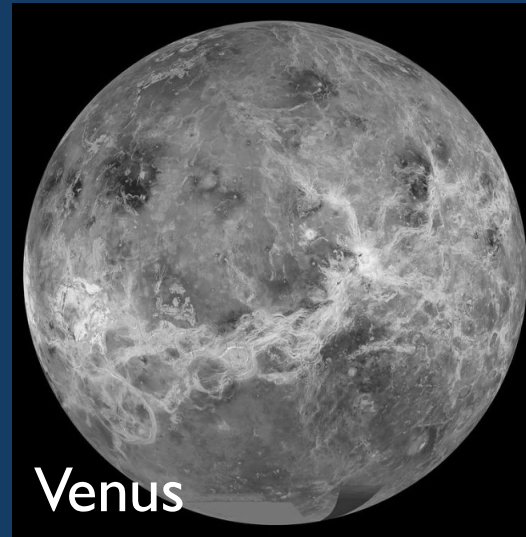


Time Period

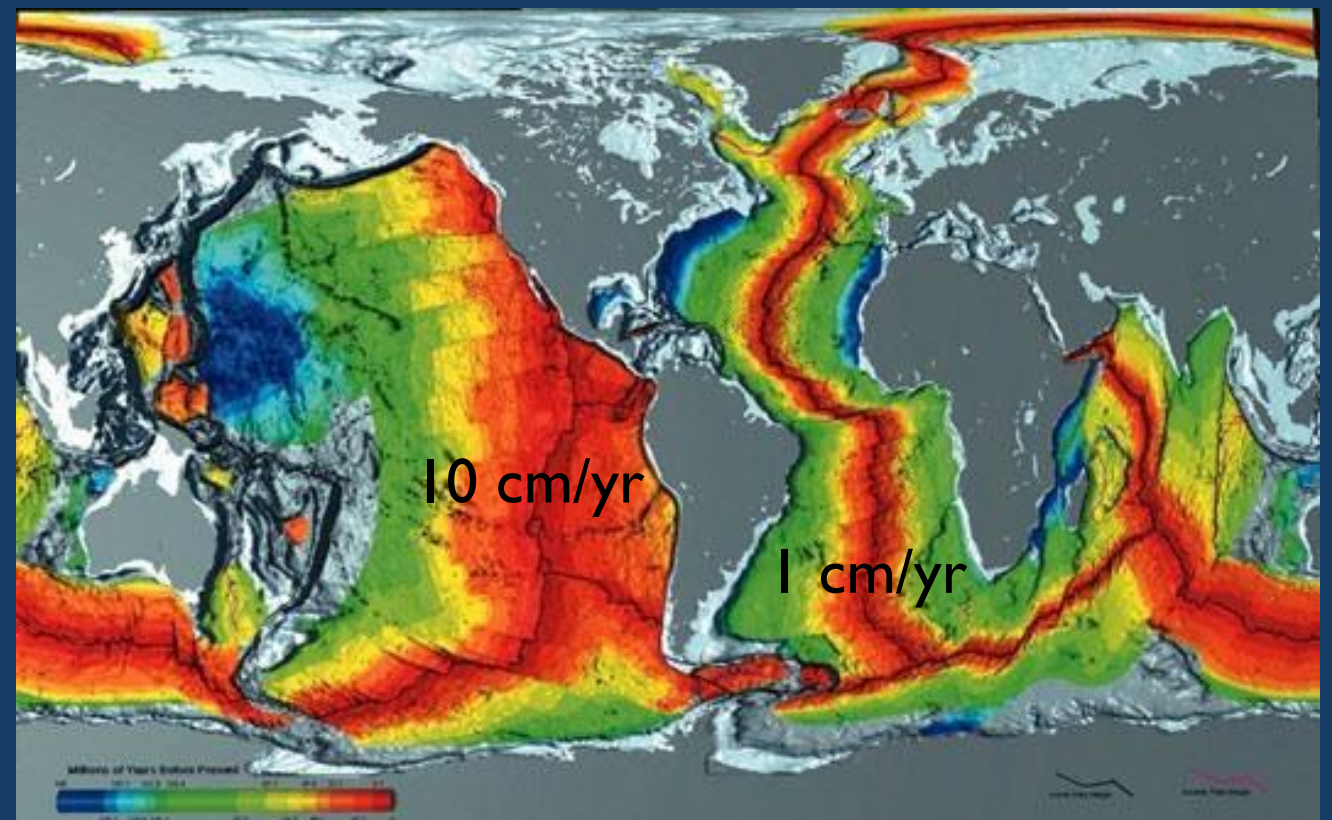
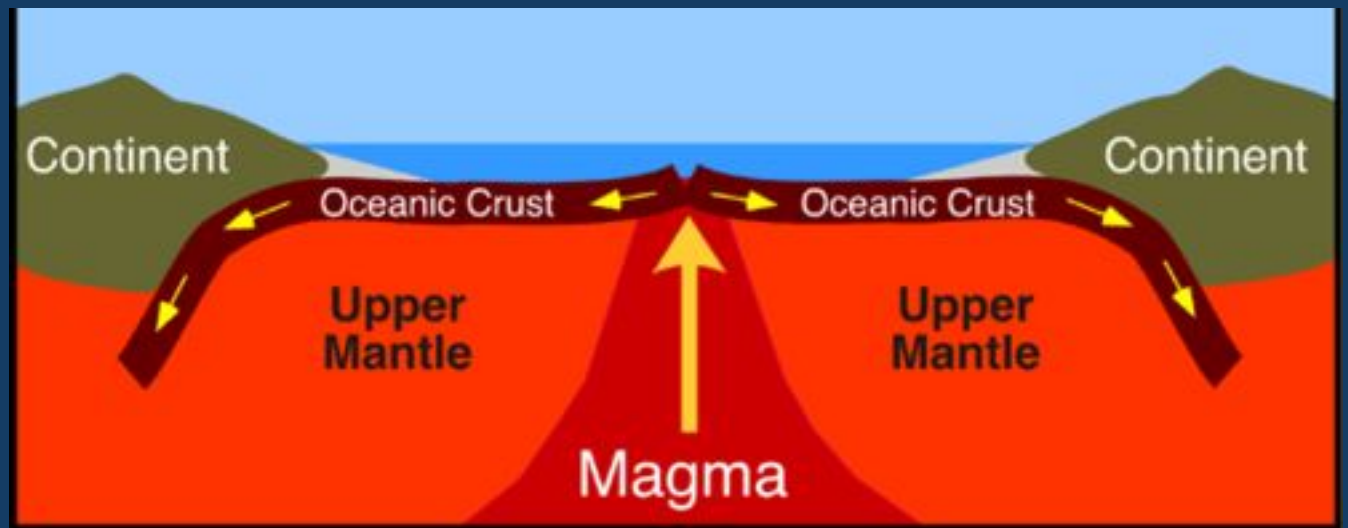
Youngest	Yellow	Cenozoic
	Light Blue	Mesozoic
	Green	Paleozoic
	Pink	Proterozoic
Oldest	Red	Archean

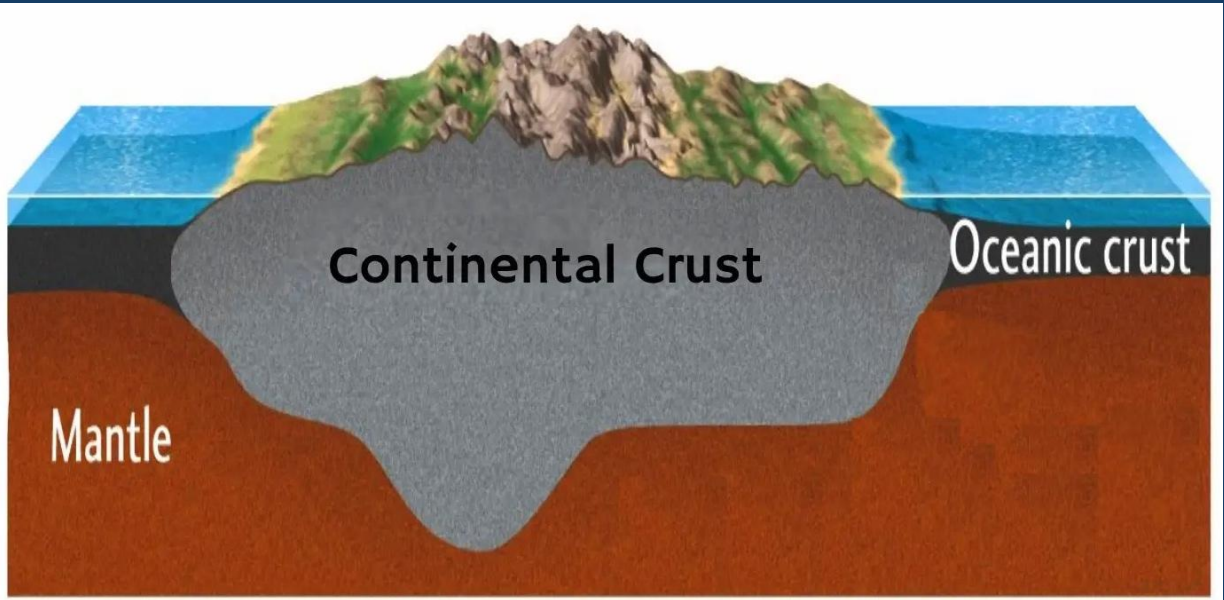
Earth squeezes
the record of
the past 4 billion
years onto the
continents





Ocean crust is born at mid-ocean ridges and has an average life span of only 170 million years before it is subducted – ‘recycled’ into the mantle

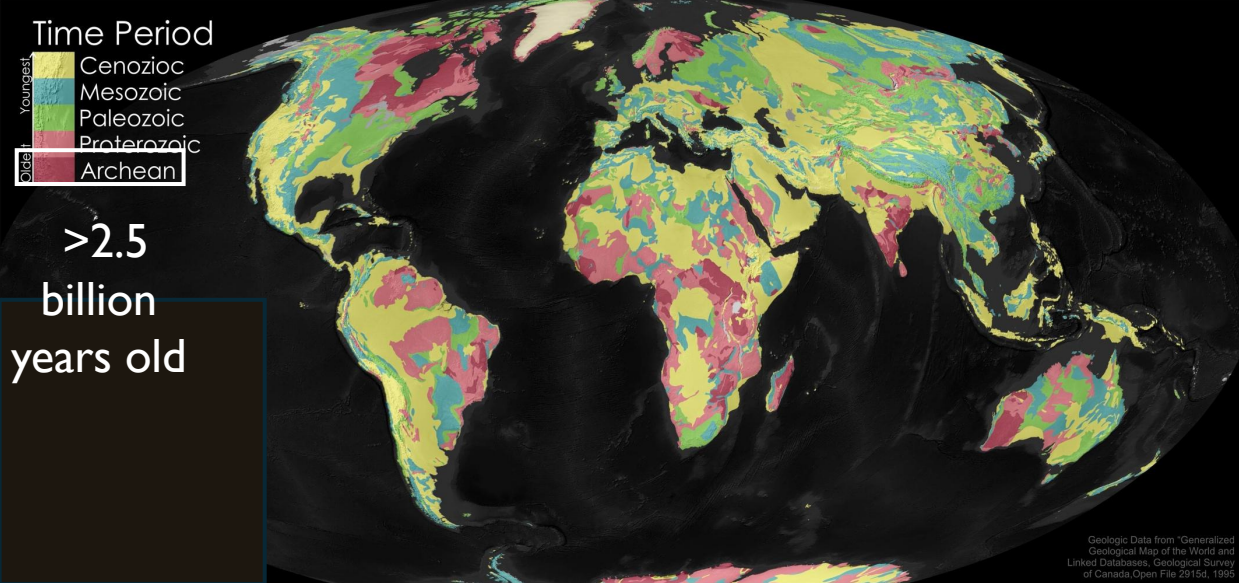




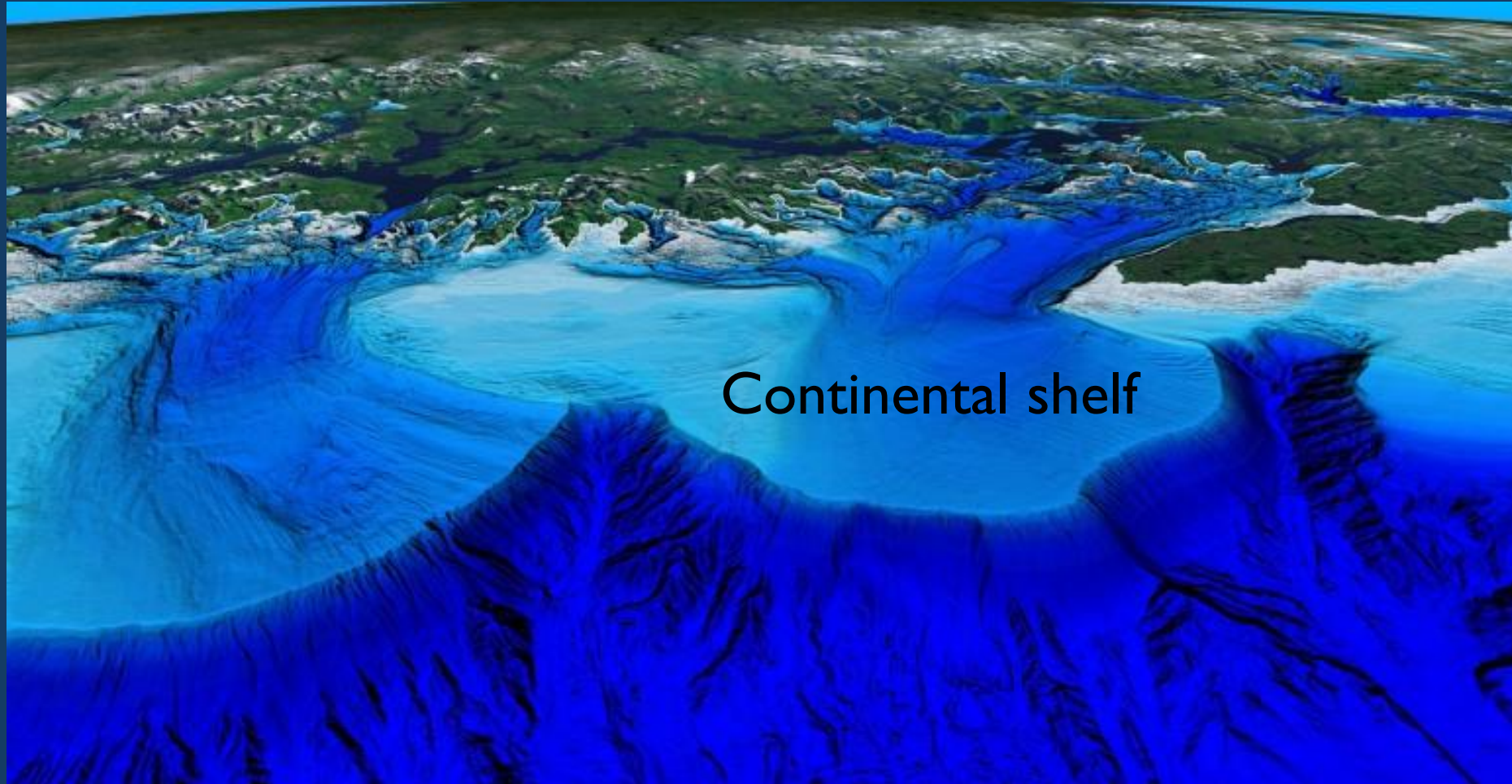
Continents are too light to be subducted back into the mantle

Continental crust has an average life span of ~2.8 *billion* years

Slowly dismantled by erosion



Most eroded continental sediments end up on the continental shelf – still part of the continent, and not subductable





Exposed continental crust: Vulnerable to erosion

Continental shelf
exempt from both erosion
and subduction

Earthsea

Ocean crust: Subject to subduction



Continental shelf sediments wrinkled
into mountain belt during collision
between continents

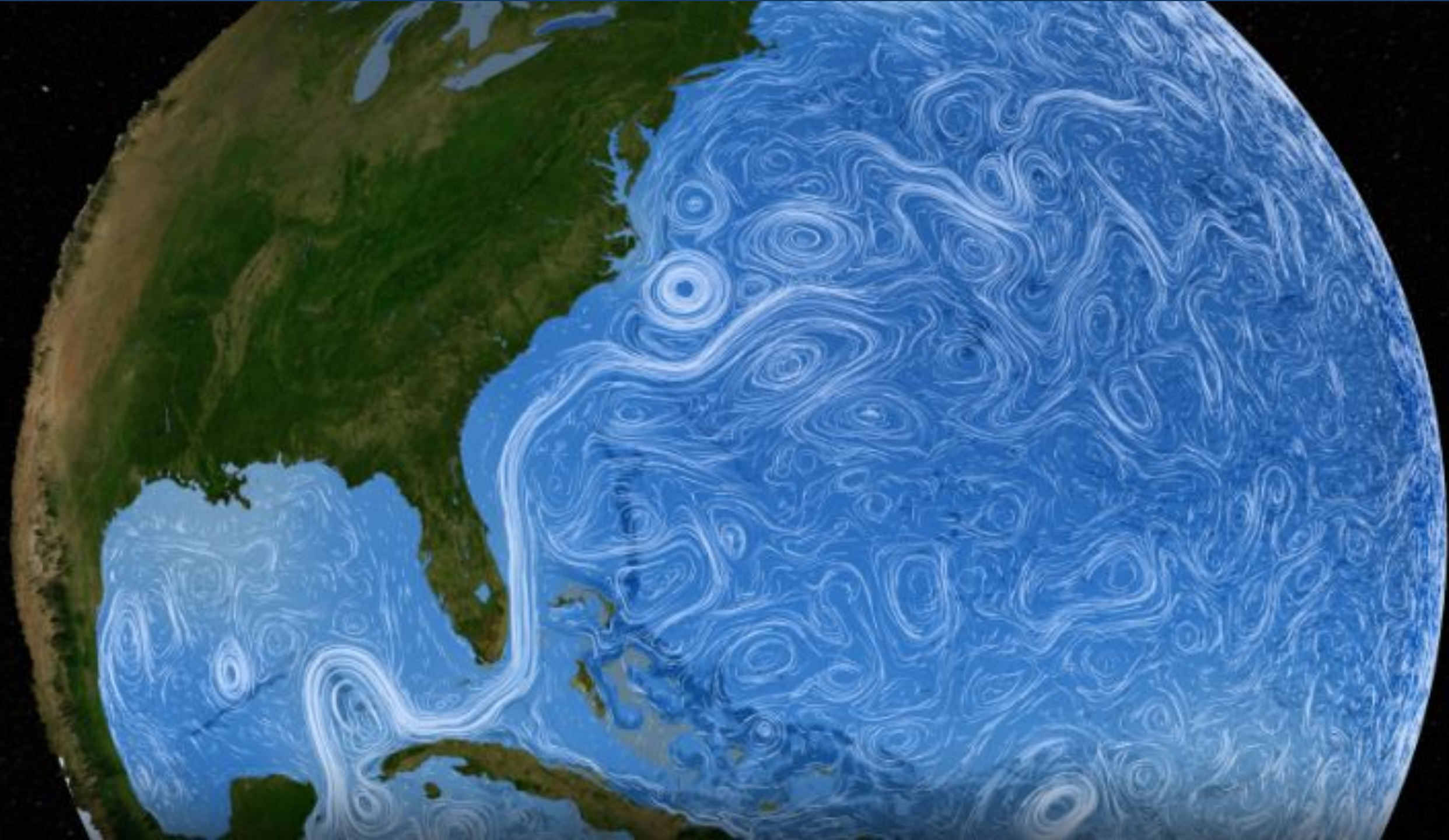
N Ellesmere Island, arctic Canada



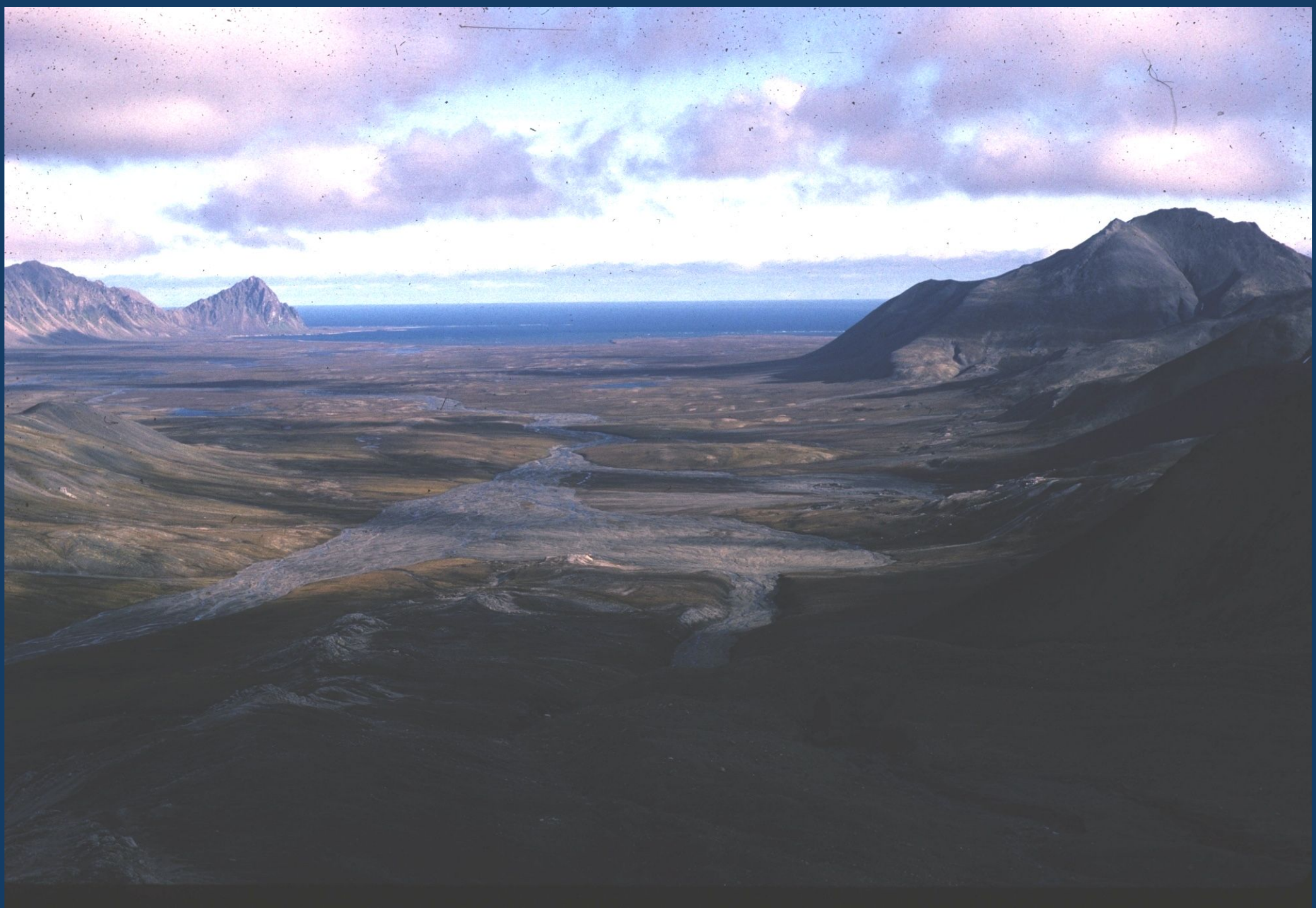


Short term holdings

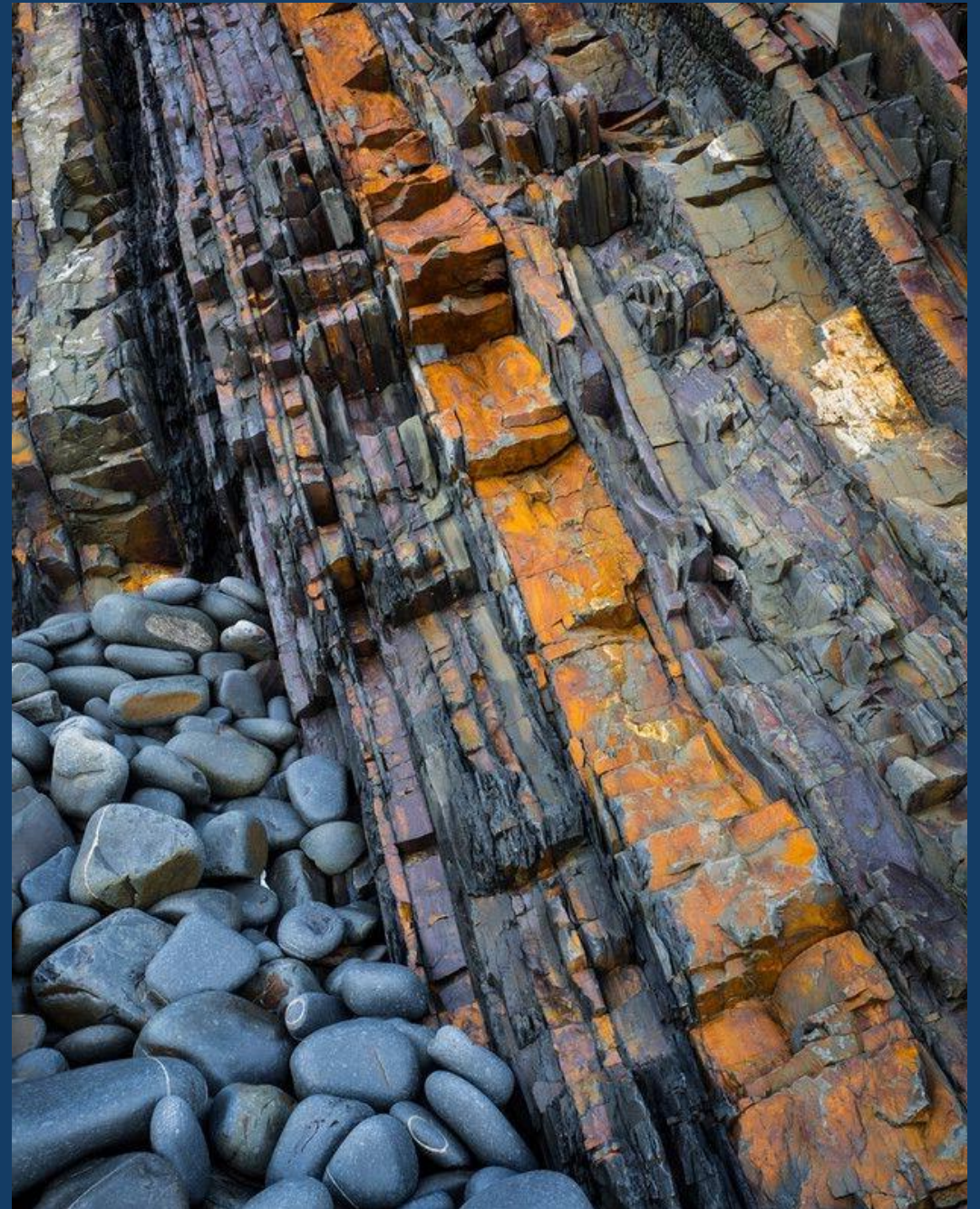
Literary canon







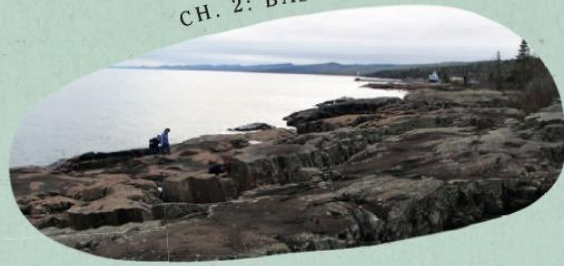
Reading the world around us: Rocks as libraries



PROLOGUE: ICE



CH. 2: BASALT



CH. 1: SANDSTONE



EPILOGUE: BEACH PEBBLES



CH. 3: TUFF



TURNING TO STONE

DISCOVERING

THE

SUBTLE

WISDOM

OF

ROCKS

MARCIA BJORNERUD

CH. 10: QUARTZITE



CH. 4: DIAMICTITE



CH. 9: GLASS AND FLINT



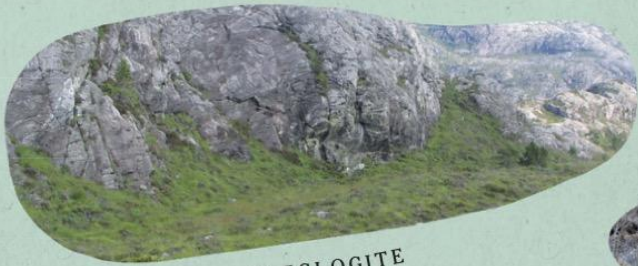
CH. 5: TURBIDITE



CH. 6: DOLOMITE



CH. 8: ECLOGITE



CH. 7: GRANITE

