



Cheryl Bartlett¹ & Albert Marshall²

¹ Cape Breton University, Sydney, NS, Canada

² Eskasoni Mi'kmaq First Nation, NS, Canada

***BC Forest Investment Account
Forest Science Program***

“Indigenous Science Funding Stream”

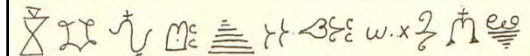
- Workshop #1, 4-5 December 2008
- Workshop #2, 8-9 January 2009

Vancouver, British Columbia

CAPE BRETON
UNIVERSITY

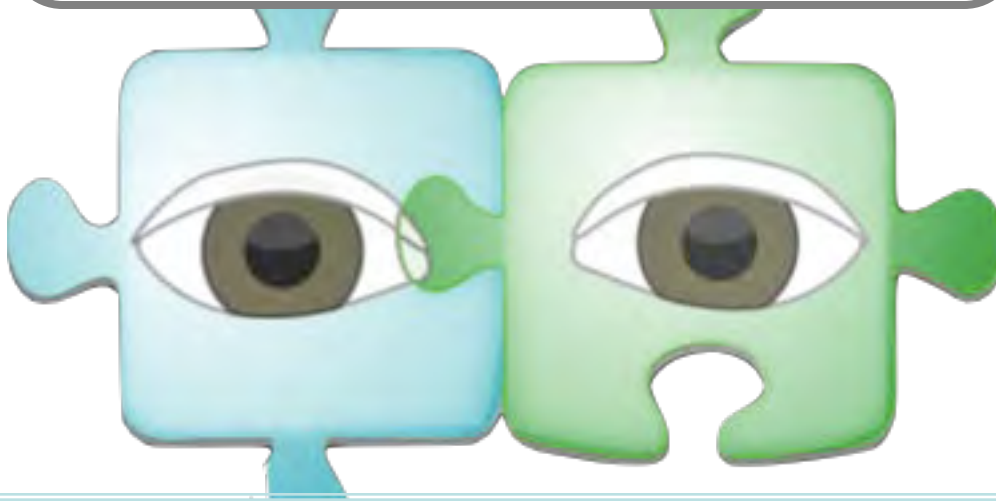
KECCA

Knowledge: Education and Cultural Consultant Associates





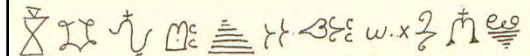
Integrative Science & Two-Eyed Seeing



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Integrative Science & Two-Eyed Seeing

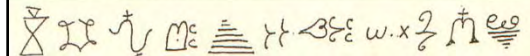
PART 1

Workshop #1, 4-5 December 2008

CAPE BRETON
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KECCA

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Canada Research
Chairs

Chaires de recherche
du Canada



Social Sciences and Humanities
Research Council of Canada

Conseil de recherches en
sciences humaines du Canada

Canada
Canada

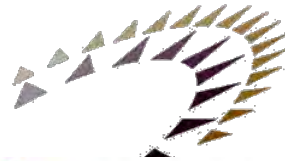
Thank you / Wela'liog

Mi'kmaq Elders



CIHR IRSC

Canadian Institutes of
Health Research Instituts de recherche
en santé du Canada



**NSERC
CRSNG**

Canada Foundation
for Innovation

Fondation canadienne
pour l'innovation



Membertou
Elementary



Mi'kmawey Debert



**IWK Health Centre
Foundation**



Eskasoni First Nation Detachment
Royal Canadian Mounted Police Gendarmerie royale
du Canada



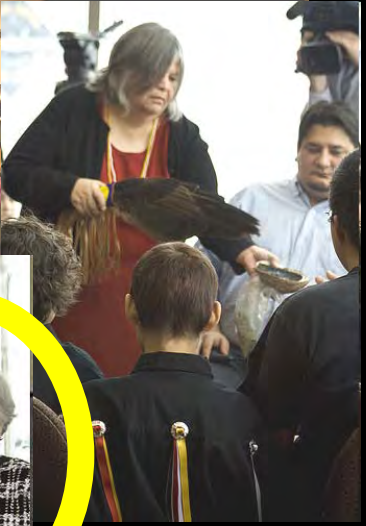
Mi'kmaq College Institute
Mi'kmaq Espi Kina'matno'kuom

The support of various partners
and funding agencies is
gratefully acknowledged.

collaboration

≈ 15 years





“See, in the Mi’kmaq world, in all Native worlds, you have to give recognition to everything: misdeeds, good deeds, past deeds, you know? Anything. You have to give that acknowledgement. Everything that you do, you have to acknowledge it.”

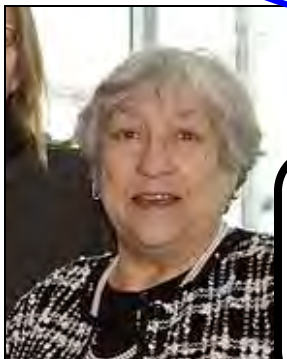
from: Iwama et al. 2007; Gaspereau Press Limited

put our *values + actions*
+ *knowledges* in front of
us ... like an object

Murdena Marshall, Elder, Mi’kmaq Nation

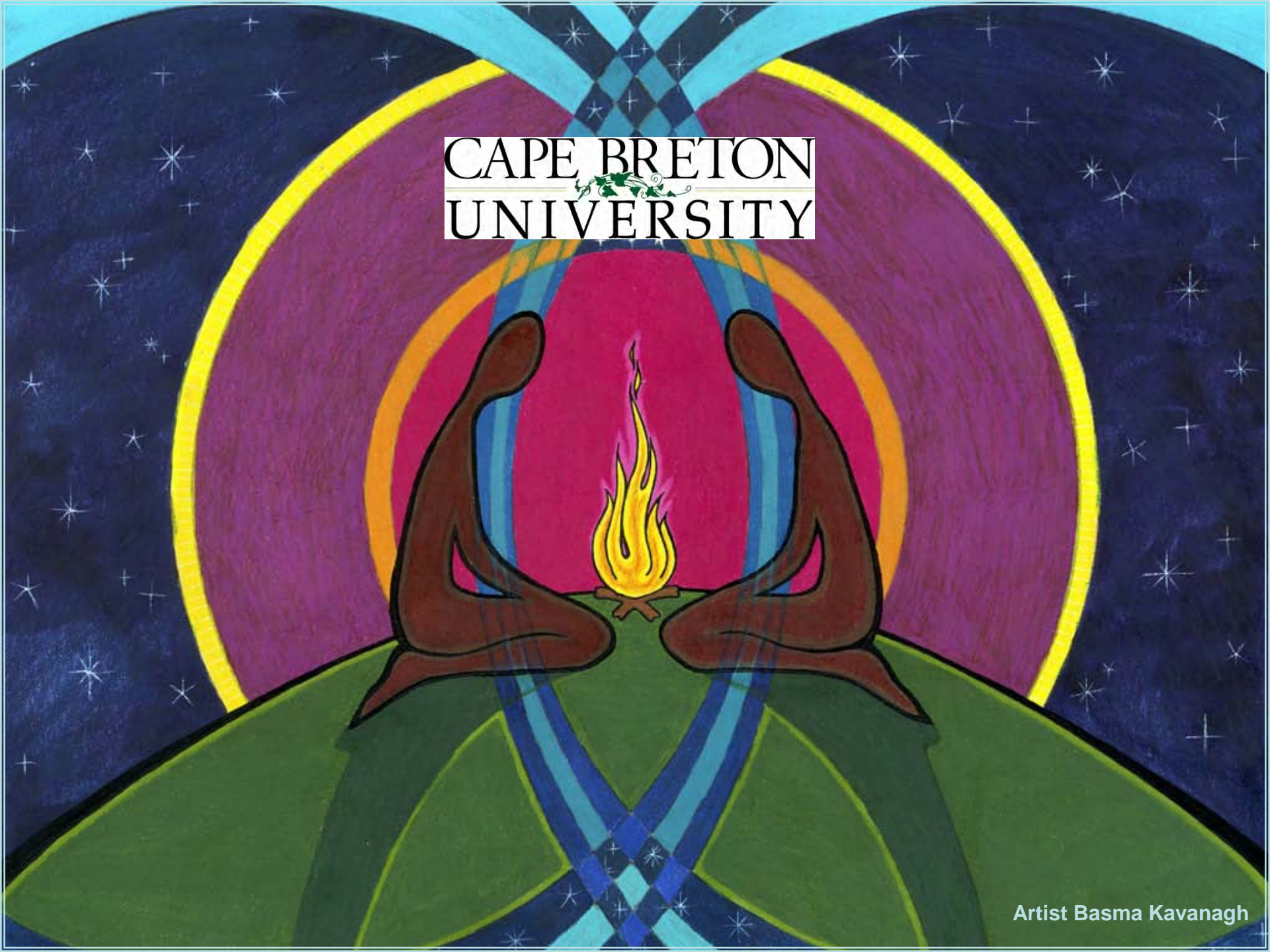
I Got It
From an
Elder

✦
Conversations
in Healing
Language



Together We Heal & Grow
seeing & acknowledging my deeds

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Artist Basma Kavanagh

Integrative Science

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Indigenous

Western

“bringing our knowledges together”

Integrative Science

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our sciences
our stories

Indigenous

our worldviews

Western

“bringing our knowledges together”

Indigenous

Western



The central dilemma of science education today is the teaching of science from only one cultural perspective, and in an incomplete and non-connected manner.

Gregory Cajete, PhD
Native American Scientist & Educator, Univ. of New Mexico

Indigenous

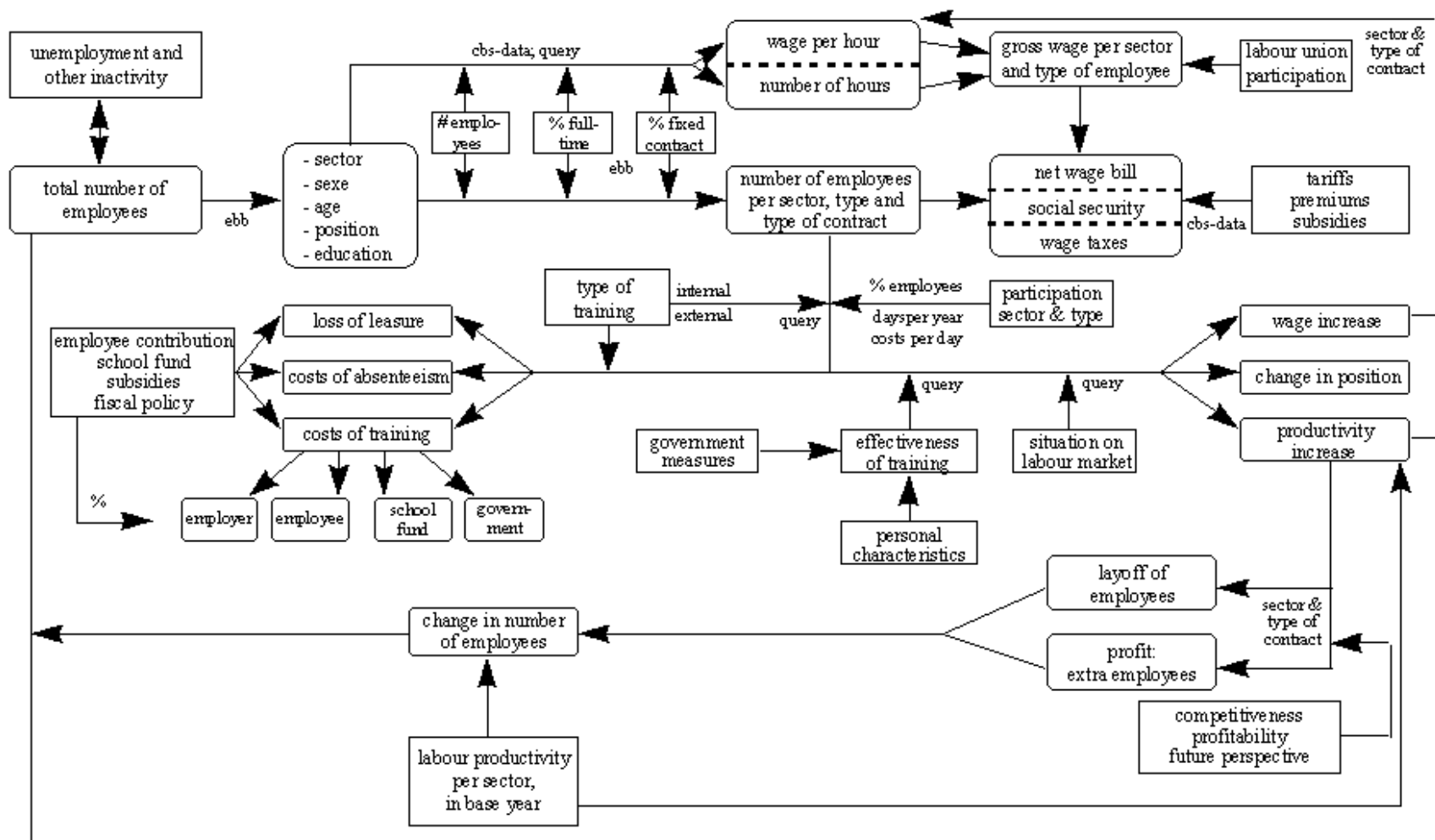
Western



The central dilemma of science education today is the teaching of science from only one cultural perspective, and in an incomplete and non-connected manner.

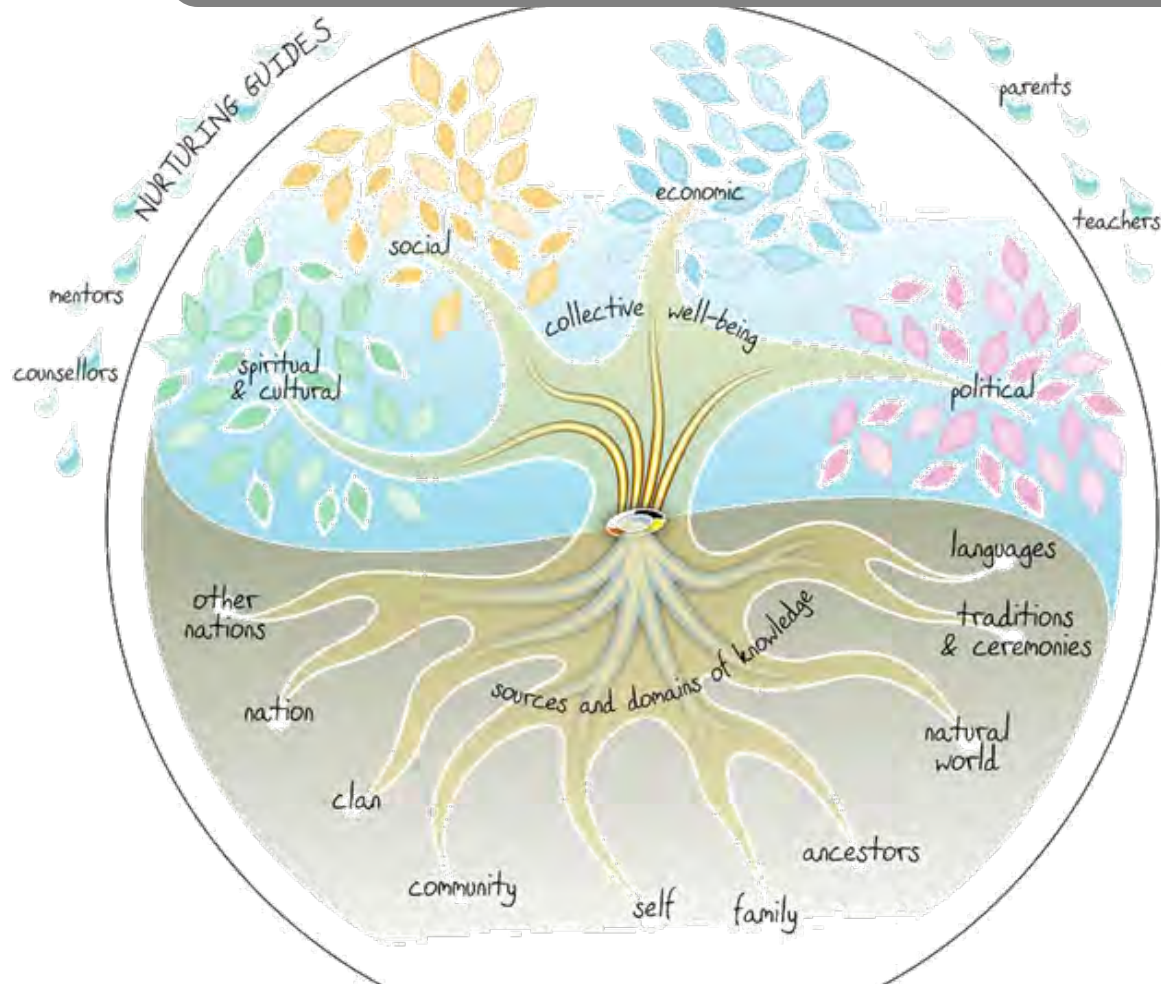
Gregory Cajete, PhD
Native American Scientist & Educator, Univ. of New Mexico

Lifelong Learning Model



Leeds University (UK) Lifelong Learning Model

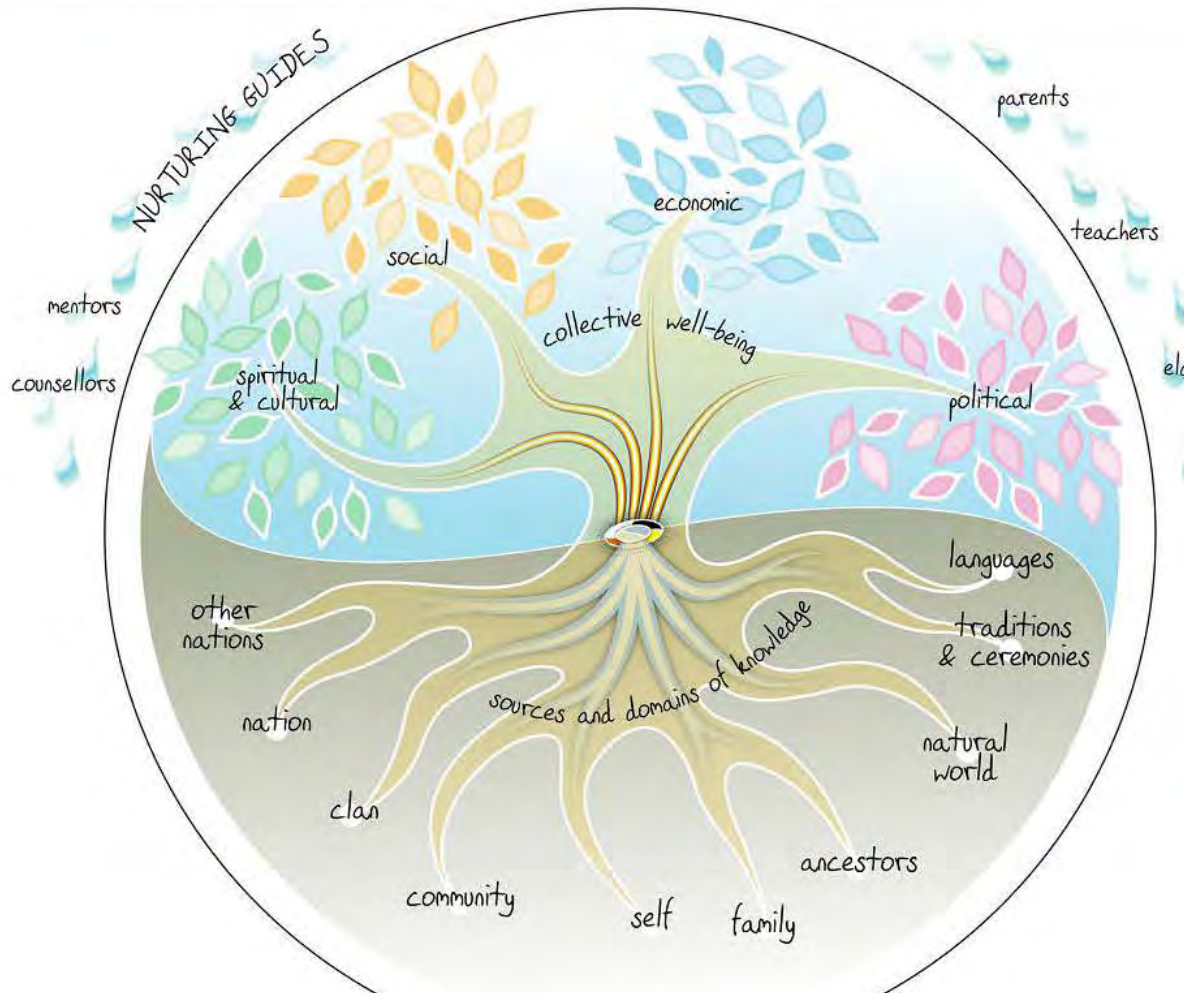
Lifelong Learning Model



First Nations Holistic Lifelong Learning Model

from: Canadian Council on Learning: Aboriginal Learning Knowledge Centre

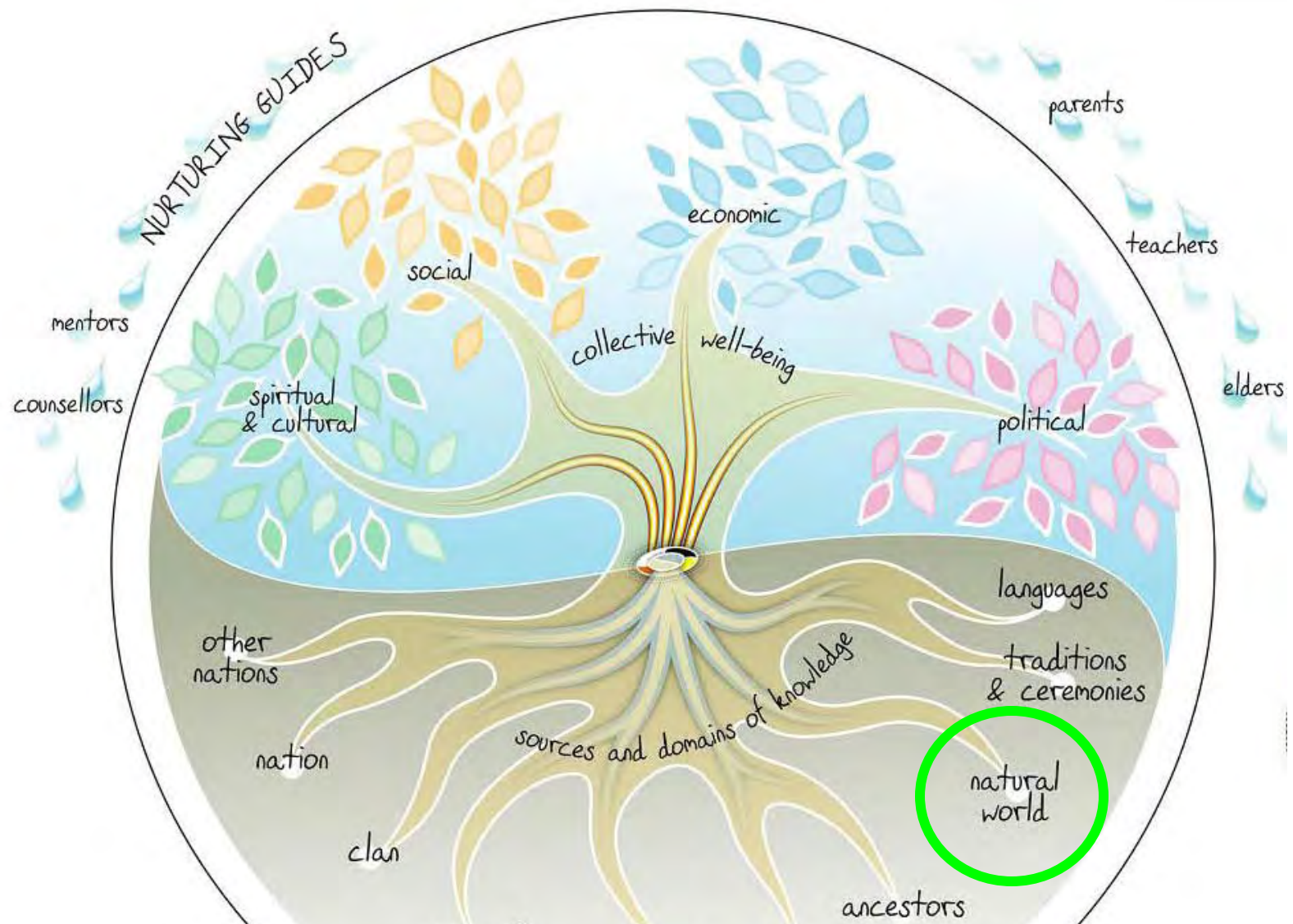
<http://www.ccl-cca/CCL>



First Nations Holistic Lifelong Learning Model

from: Canadian Council on Learning: Aboriginal Learning Knowledge Centre

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First Nations Holistic Lifelong Learning Model

from: Canadian Council on Learning: Aboriginal Learning Knowledge Centre

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Science:
“stories of our interactions
with and within nature”

**Indigenous and Western
scientific knowledges are
based in observations
of the natural world.**

**Science is dynamic,
pattern-based knowledge.**



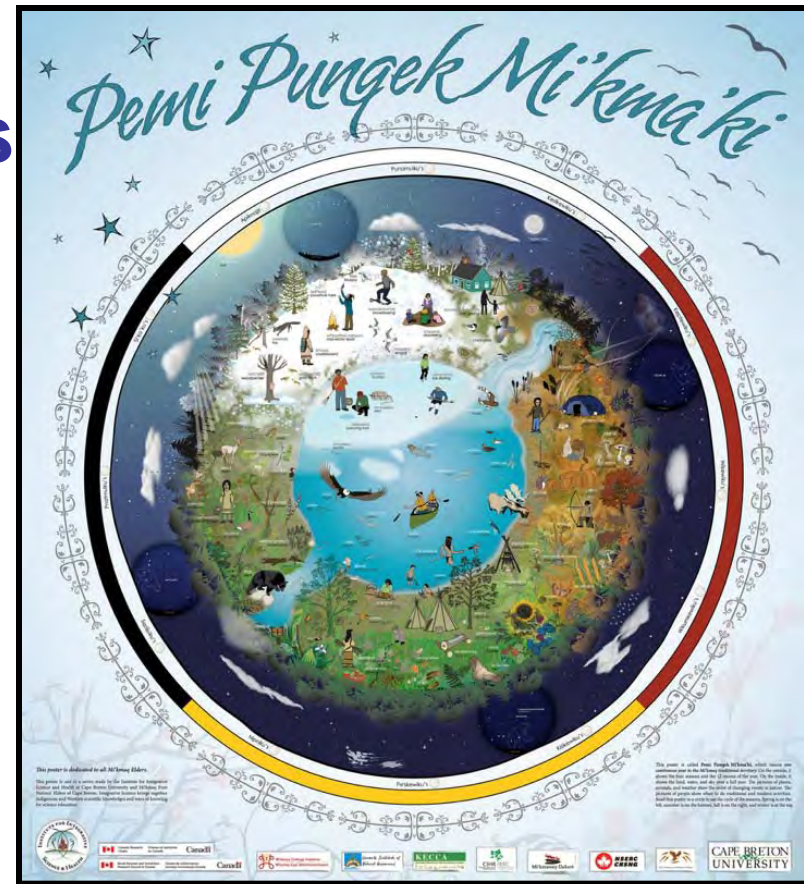
INTERNATIONAL YEAR OF ASTRONOMY 2009



Science:
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natural
world



**Science is
dynamic,
pattern-based
knowledge.**



stories of our interactions with and within nature



stories of our interactions with and within nature

Science

Life
Love
Land

Welcome to ACCHS Regional Aboriginal Health Team

...n System

...me of information ser...

...the Promises

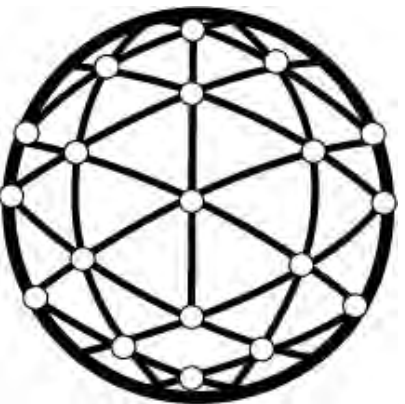
stories of our interactions with and within nature

Science

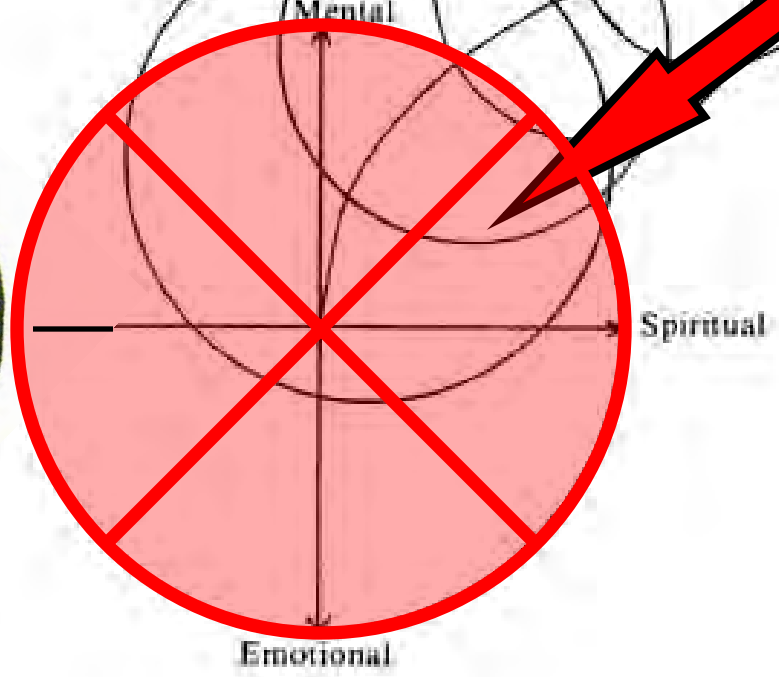
H																	He					
Li	Be											B	C	N	O	F	Ne					
Na	Mg											Al	Si	P	S	Cl	Ar					
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Cu			Ni	Zn	Ga	Ge	As	Se	Br	Kr				
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh				Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe		
Cs	Ba												Pb	Bi	Po	At	Rn					
Fr	Ra																					
																		Ho	Er	Tm	Yb	Lu
																		Es	Fm	Md	No	Lr

SCIENCE stories of:
interconnectiveness

Vision 

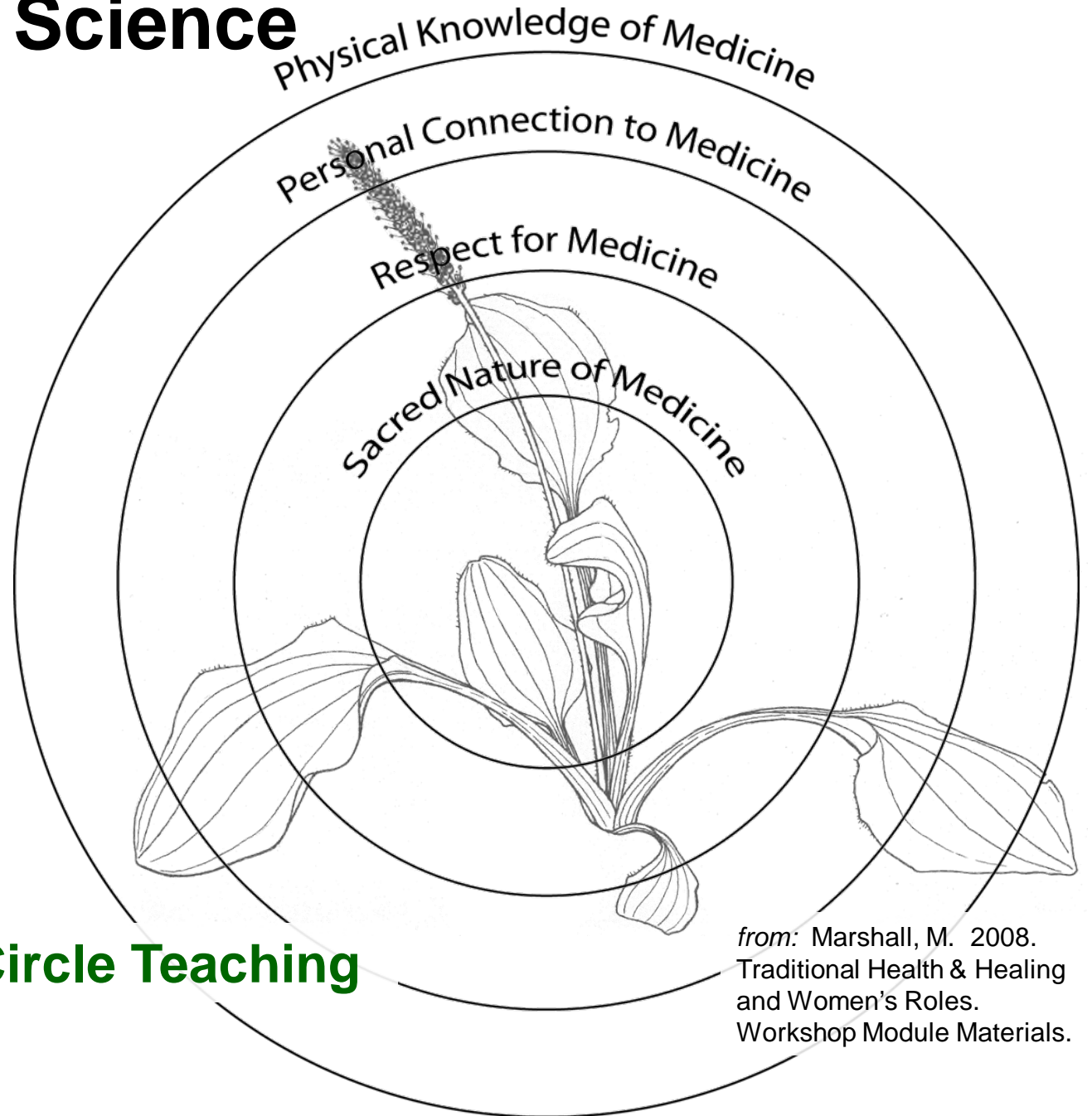


Artist: Rod Restoule
from: Into the Daylight;
C. Morrisseau, 1998



my world is "all my relations" (subjects)

Indigenous Science



Sacred Circle Teaching

from: Marshall, M. 2008.
Traditional Health & Healing
and Women's Roles.
Workshop Module Materials.

Indigenous Science



Life
Love
Land

Language



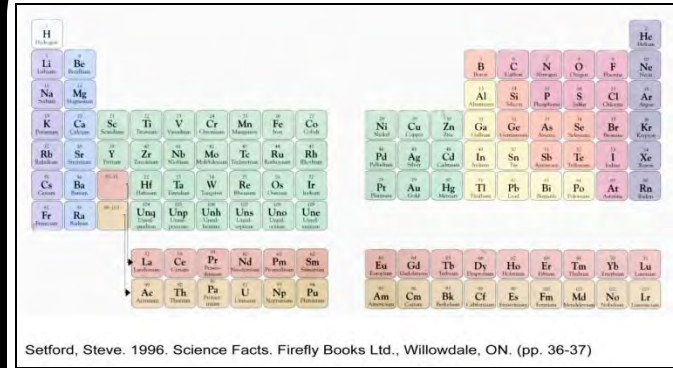
images from: Aboriginal organizations/artists, various sources

Indigenous Science



images from: Aboriginal organizations/artists, various sources

Universe: Visible Matter (levels of organization - biology)

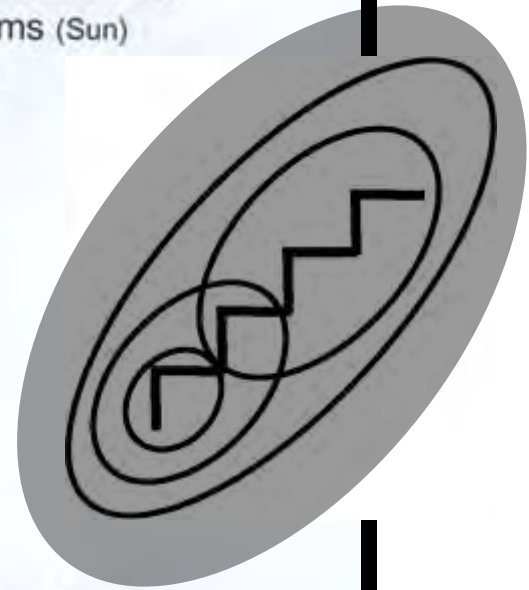


A standard periodic table of elements, color-coded by groups. It includes elements from Hydrogen (H) to Oganesson (Og), with the Lanthanide and Actinide series shown below the main table.

Setford, Steve. 1996. Science Facts. Firefly Books Ltd., Willowdale, ON. (pp. 36-37)



- Universe
- super clusters (Local)
- clusters (Local Group)
- galaxies (Milky Way)
- star systems (Sun)
- planet Earth
- ecosystems
- communities
- populations
- organisms
- organ systems
- organs
- tissues
- cells
- organelles
- molecules & minerals
- atoms (natural elements #1-92;
- baryons (neutrons & protons)
- fundamental particles (quarks & leptons)

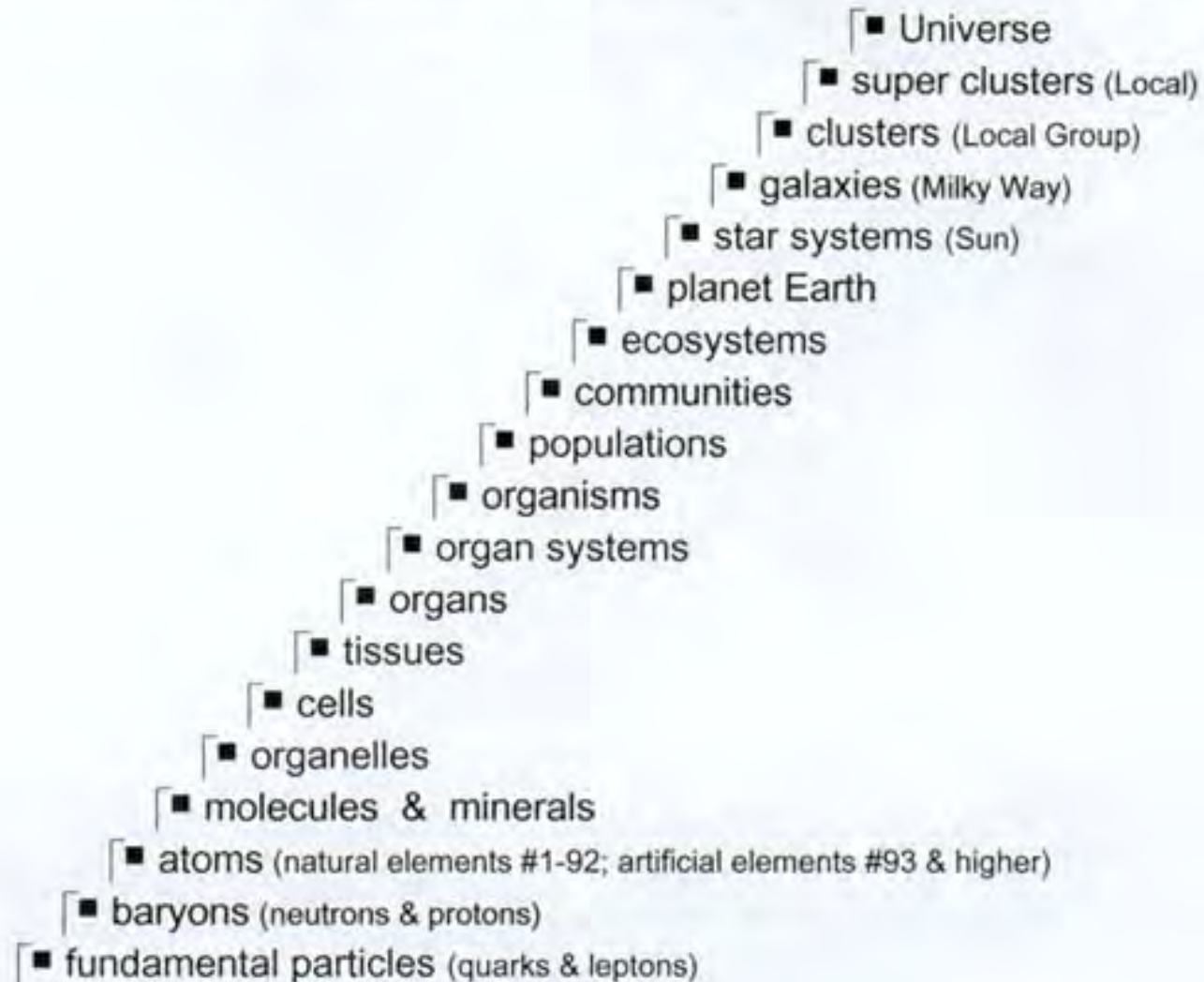


**SCIENCE stories of:
parts & wholes**

my world is many "its" (objects)

Western Science

Universe: Visible Matter (levels of organization - biology)



Western Science

Universe: Visible Matter (levels of organization - biology)

H																	He	
Li	Be											B	C	N	O	F	Ne	
Na	Mg											Al	Si	P	S	Cl	Ar	
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
Fr	Ra	Unq	Unp	Unh	Uns	Uno	Unl											
		La	Ce	Pr	Nd	Pm	Sm											
		Ac	Th	Pa	U	Np	Pu											
								Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr		

Setford, Steve. 1996. Science Facts. Firefly Books Ltd., Willowdale, ON. (pp. 36-37)

- Universe
- super clusters (Local)
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- galaxies (Milky Way)
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- planet Earth
- ecosystems
- communities
- populations
- organisms
- organ systems
- organs
- tissues
- cells
- organelles
- molecules & minerals
- atoms (natural elements #1-92; artificial elements #93 & higher)
- baryons (neutrons & protons)
- fundamental particles (quarks & leptons)

photo credit: NRC



Western Science

1 H Hydrogen																	2 He Helium
3 Li Lithium	4 Be Beryllium															10 Ne Neon	
11 Na Sodium	12 Mg Magnesium															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							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							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							86 Rn Radon		
87 Fr Francium	88 Ra Radium	89-103 Actinides	104 Unq Unnilquadium	105 Unp Unnilpentium	106 Unh Unnilhexium	107 Uns Unnilseptium	108 Uno Unniloctium	109 Une Unnilennium									
		89 La Lanthanum	90 Ce Cerium	91 Pr Praseodymium	92 Nd Neodymium	93 Pm Promethium	94 Sm Samarium										
		95 Ac Actinium	96 Th Thorium	97 Pa Protactinium	98 U Uranium	99 Np Neptunium	100 Pu Plutonium										

																1 H Hydrogen																
																2 He Helium																
																3 Li Lithium	4 Be Beryllium															10 Ne Neon
																11 Na Sodium	12 Mg Magnesium															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							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							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							86 Rn Radon	
																87 Fr Francium	88 Ra Radium	89-103 Actinides	104 Unq Unnilquadium	105 Unp Unnilpentium	106 Unh Unnilhexium	107 Uns Unnilseptium	108 Uno Unniloctium	109 Une Unnilennium								
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photo credit: NRC

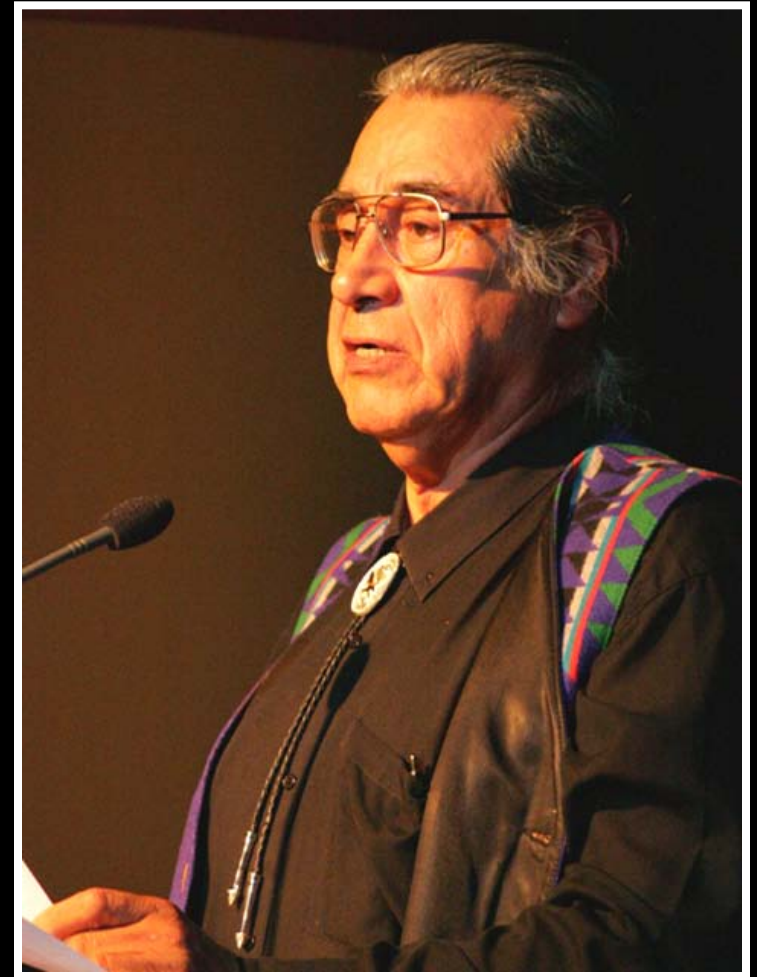
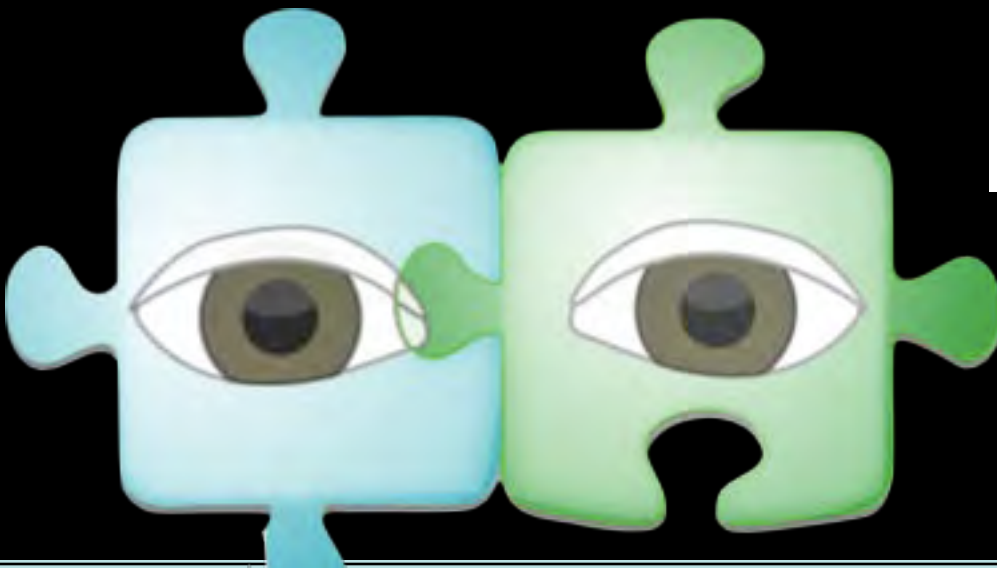


Western Science

A large, black, hand-drawn scribble is overlaid on the periodic table, starting from the top right and moving towards the bottom left, partially obscuring the elements.

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 Unq Unnilquadium	105 Unp Unpentium	106 Unh Unhexium	107 Uns Unseptium	108 Uuo Unoctium	109 Uuh Unnonium	110 Uuq Unquadrium	111 Uuh Unhennium	112 Uuo Unoctium	113 Uut Untrium	114 Uuq Unquadrium	115 Uup Unpentium	116 Uuq Unquadrium	117 Uup Unpentium	118 Uuo Unoctium
		89 La Lanthanum	90 Ce Cerium	91 Pr Praseodymium	92 Nd Neodymium	93 Pm Promethium	94 Sm Samarium	95 Eu Europium	96 Gd Gadolinium	97 Tb Terbium	98 Dy Dysprosium	99 Ho Holmium	100 Er Erbium	101 Tm Thulium	102 Yb Ytterbium	103 Lu Lutetium	
		97 Ac Actinium	98 Th Thorium	99 Pa Protactinium	100 U Uranium	101 Np Neptunium	102 Pu Plutonium	103 Am Americium	104 Cm Curium	105 Bk Berkelium	106 Cf Californium	107 Es Einsteinium	108 Fm Fermium	109 Md Mendelevium	110 No Nobelium	111 Lr Lawrencium	

Two-Eyed *Seeing*



Elder Albert Marshall
Eskasoni community
Mi'kmaq Nation

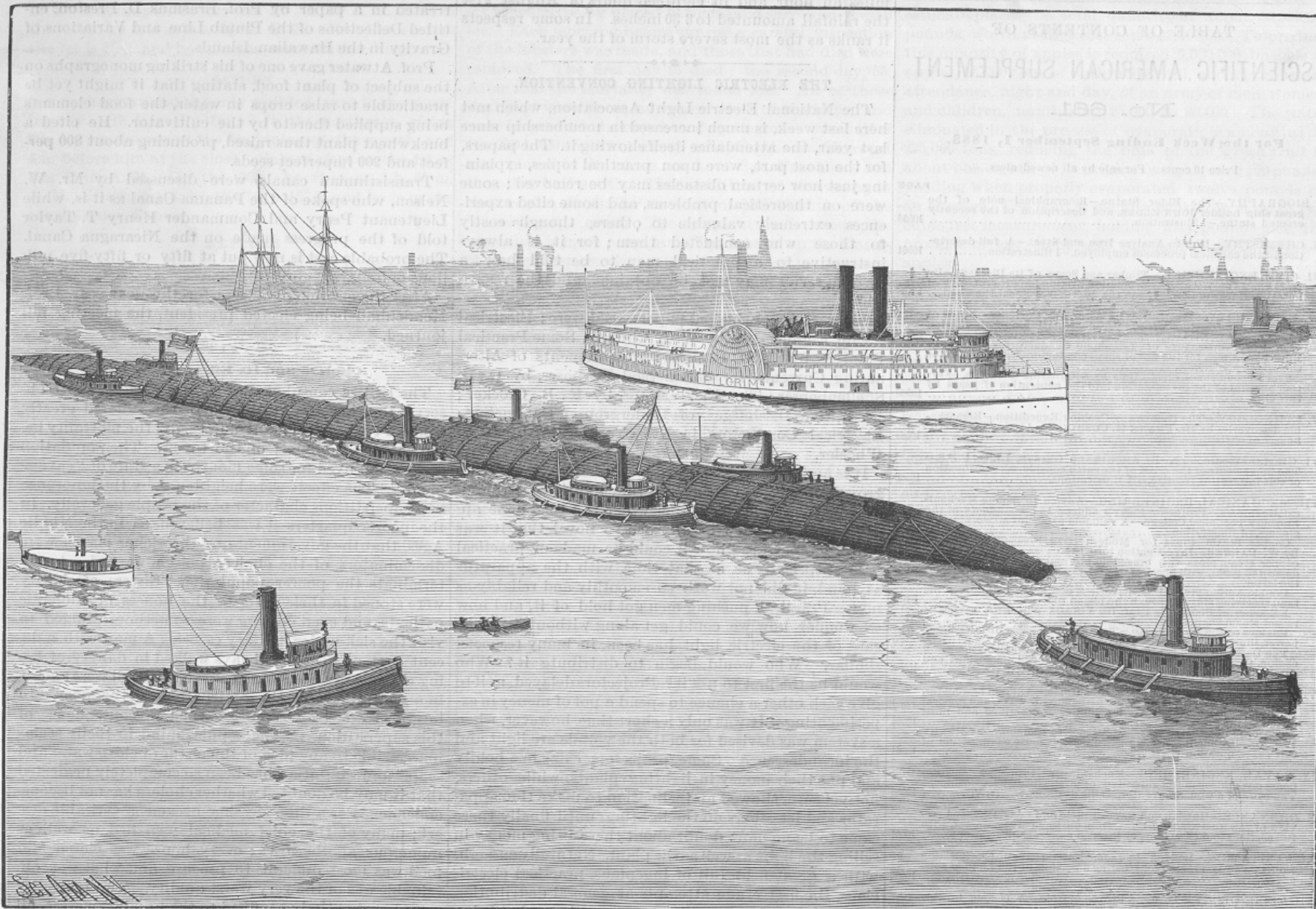
“LEARN ... to see from one eye with the strengths of Indigenous knowledges and ways of knowing, and from the other eye with the strengths of Western (or Eurocentric or mainstream) knowledges and ways of knowing ... and to use both these eyes together, for the benefit of all.”



TWO-EYED SEEING







THE GREAT TIMBER RAFT FROM JOGGINS, NOVA SCOTIA.

TABLE OF CONTENTS OF
SCIENTIFIC AMERICAN SUPPLEMENT

Vol. 62.

For the Week Ending September 5, 1888.

The following articles are contained in this issue:

The Great Timber Raft from Joggins, Nova Scotia. (See page 100.)

The Electric Lighting Convention. (See page 105.)

The National Electric Light Association. (See page 110.)

The Atlantic Cable. (See page 115.)

The Panama Canal. (See page 120.)

The Nicaragua Canal. (See page 125.)

The Great Lakes. (See page 130.)

The St. Lawrence River. (See page 135.)

The Gulf of St. Lawrence. (See page 140.)

The Bay of Fundy. (See page 145.)

The Strait of Bellefleur. (See page 150.)

The Gulf of Gaspé. (See page 155.)

The Gulf of St. Lawrence. (See page 160.)

The Bay of Fundy. (See page 165.)

The Strait of Bellefleur. (See page 170.)

The Gulf of Gaspé. (See page 175.)

The Gulf of St. Lawrence. (See page 180.)

The Bay of Fundy. (See page 185.)

The Strait of Bellefleur. (See page 190.)

The Gulf of Gaspé. (See page 195.)

The Gulf of St. Lawrence. (See page 200.)

MI'KMAQ WINTER LODGE

Top vent are created as required, especially in larger lodges with interior fires

WALL SECTION

- Bent wood battens
- Birch bark cladding
- Bent wood frame
- Sphagnum moss insulation
- Inner cladding of bark or skin
- Inner bent wood framing

Horizontal inner bent wood rings are at back support height.

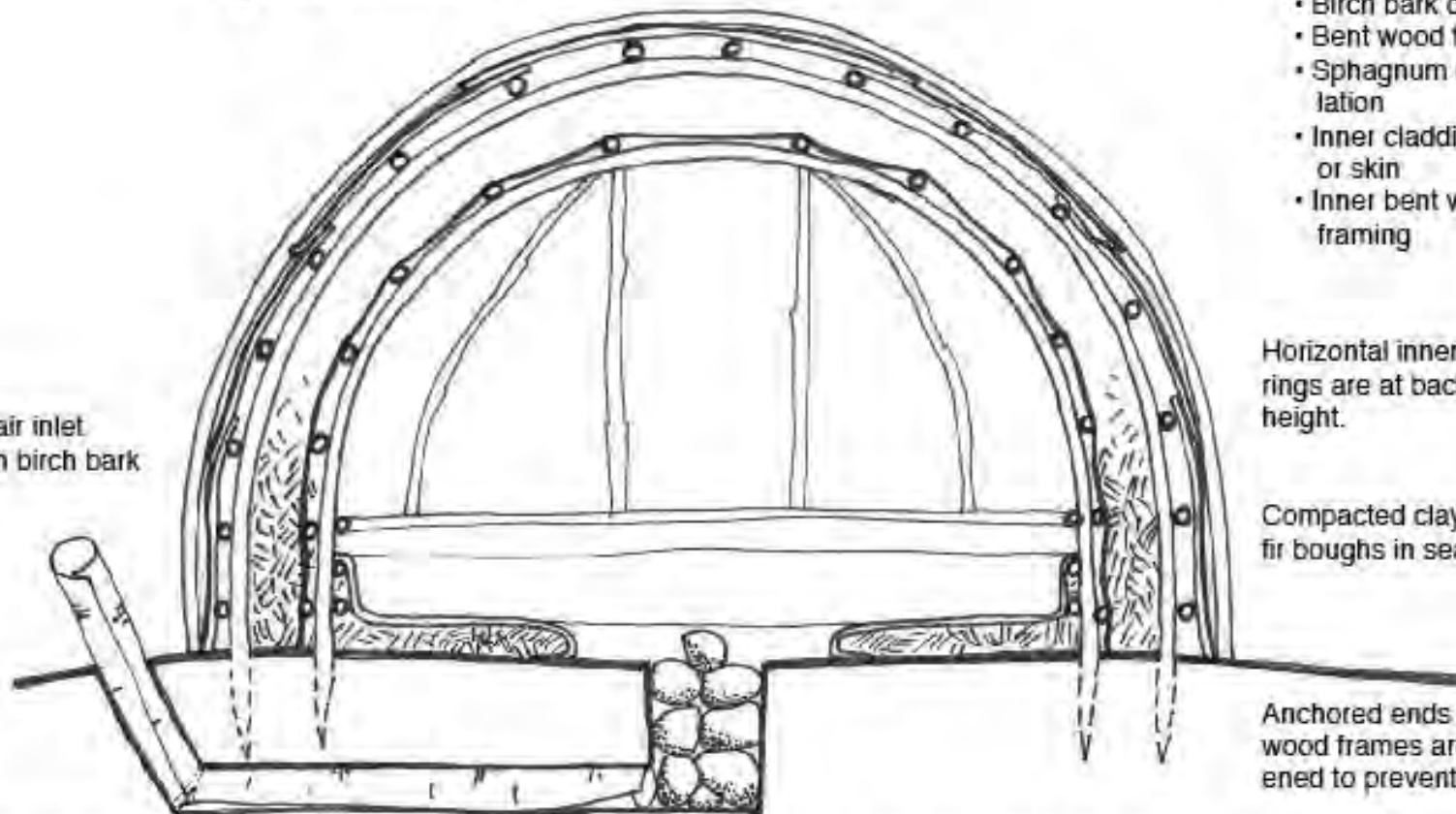
Compacted clay floor with fir boughs in seating areas.

Anchored ends of bent wood frames are fire hardened to prevent rot.

Fresh air inlet through birch bark tube.

Birch bark is water proof as well as rot and fungus resistant.

Basalt stones are preheated over an outdoor fire, then placed in the pit, to preserve indoor air quality. The mass of the stones and surrounding earth retain heat.













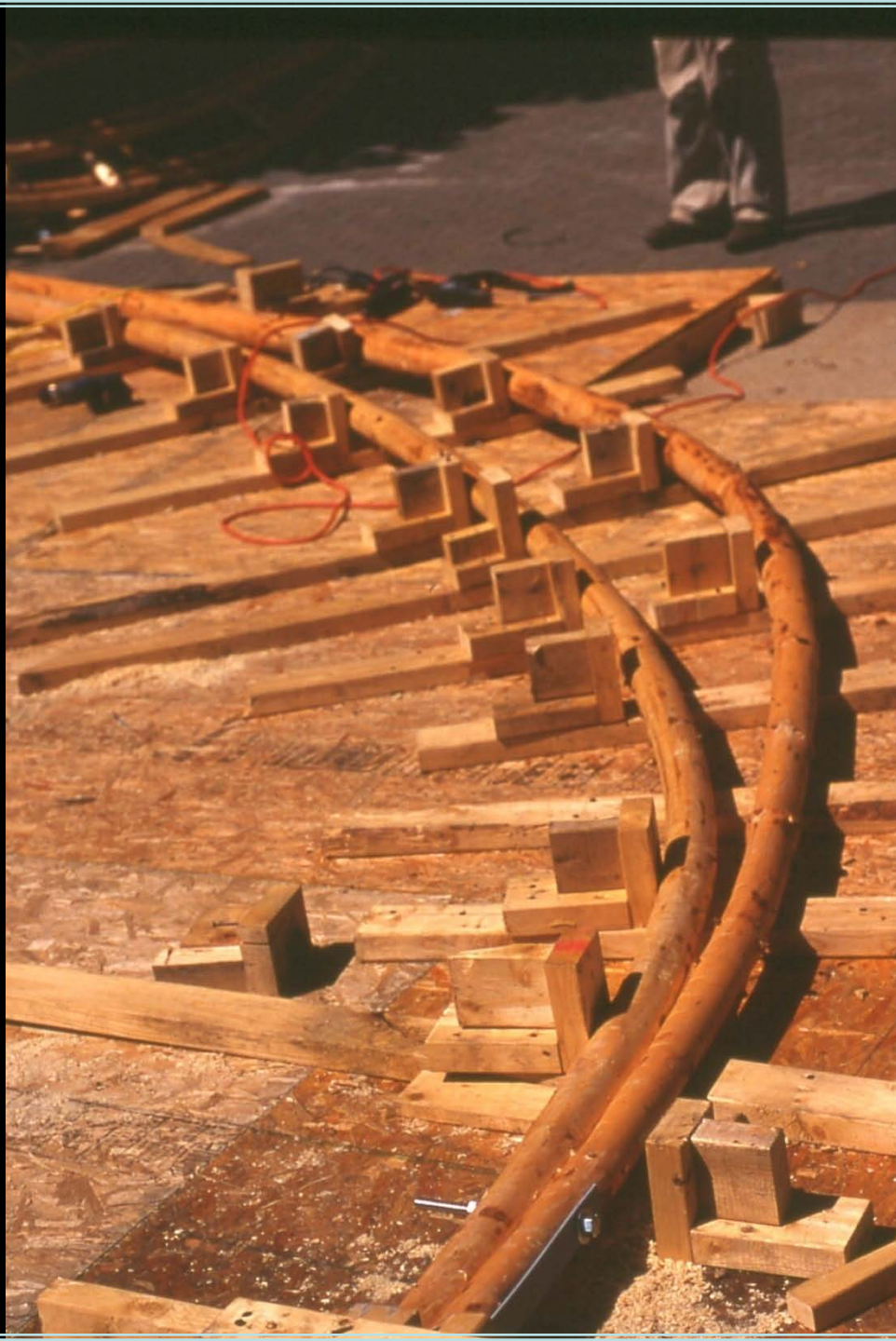






































Albert



Cheryl



End Part 1



Wela'liog

Thank you



Canada Research
Chairs

Chaires de recherche
du Canada



Social Sciences and Humanities
Research Council of Canada

Conseil de recherches en
sciences humaines du Canada

Canada
Canada

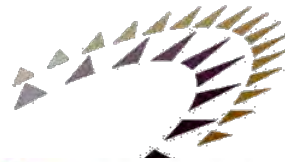
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Mi'kmaq Elders



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Membertou
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Mi'kmaq Espi Kina'matno'kuom

The support of various partners
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