Origin of Soil and Human Culture

Introduction to Soil Science

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http//:timetraveler.html.xdomain.jp

How large is our Earth?

Diameter: 12739 km

Circumference at the equator: 40,000 km

The highest mountain: 8.8 km

The deepest sea: 10.9 km

Sizes of earth and biosphere (1)

	Actual size		Assuming that the diameter of earth is 1m	
Circumference of earth	40,000	km	3.14	m
Diameter of earth	12379	km	1.00	m
Thickness of earth crust	50	km	3.93	mm
Height of Mt. Everest	8.85	km	0.69	mm
Depth of Mariana Trench	10.9	km	0.86	mm
Height of troposphere	9	km	0.71	mm
Height of stratosphere	50	km	3.93	mm

Sizes of earth and biosphere (2)

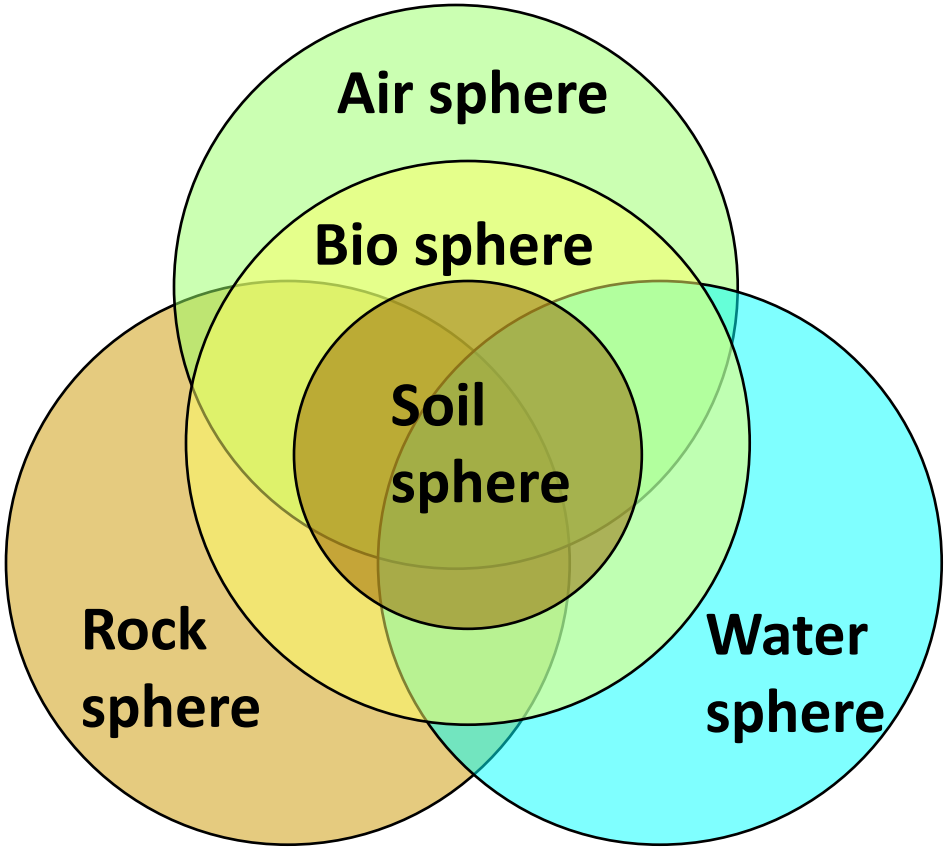
	Actual size		Assuming that the diameter of earth is 1m	
Thickness of surface soil	18	cm	0.014	µm
Thickness of soil water	11	cm	0.0086	µm
Thickness of atmosphere	15	km	1.18	mm
Thickness of ozone layer	3.00	mm	0.000236	µm

Distance from the surface of earth

	Actual size		Assuming that the diameter of earth is 1m	
Space shuttle	400	km	31.4	mm
Weather satellite	36,000	km	2.83	m
Moon	380,000	km	29.8	m
Sun	1.5 billion	km	11.8	km

Since when soil existed in the history of earth?

Years b. present	Important Events	Atmosphere	Soil
4.6×10^9	Birth of Earth		
4.0×10^9	Ocean of HCl	CO_2 97 %	
	Rock solubilization → Neutral Ocean		
	Precipitation of $CaCO_3$		
3.8×10^9	Evolution of aquatic anaerobic microbes.		
$3.5 - 2.7 \times 10^9$	Evolution of stromalite. Origin of photo-synthesis.		
2.0×10^9	Evolution of sea algae.	O_2 0.2 %	
0.6×10^9	Evolution of lichen and terrestrial organisms.	O_2 2 %	Start of root and
0.4×10^9	Evolution of early terrestrial plants.	O_2 21 %	Early soil formation
0.3×10^9	Evolution of fern and cycad.		Soil formation
200,000	Evolution of humankind		
10,000	Homo sapiens sapiens		
6,000	Start of agriculture		



Placing of soil sphere

Soil sphere exists in the biosphere

- Living things created the soil.
- Soil does not exists where there is no life.
- Living things enrich the soil, in order to improve the living environment of themselves and their descendants.

“Soil is living”
What does it mean ? (1)

- Various living things are living in the soil, and it looks as if soil itself is living.
- Functions of respiration and decomposition are the typical example of “soil life”.

“Soil is living”
What does it mean ? (2)

- Soil supports the lives of soil organisms and plants (crops), and further the lives of animals and human who feed on them.

“Soil is living”
What does it mean ? (3)

- Soil is born, matures, ages and dies as if it is a living thing.
- Such process of soil life is called the action of soil formation.

Relationship between “Humus” and “Human”.

- I realized that the words “Humus” and “Human” are similar.
- Are there any relationships between them?

Subconscious awareness of the relationship between the human life and soil.

- “Homo ab Humo”. Latin phrase for “Human from soil”
- Human (Homo) was born from humus, soil, and earth (Humo).
- In Greek myths, roman myths, and the Bible.

Adam was also created from soil.

- Genesis in the Old Testament.
- Adam (the first man) was created from Adamah (soil) by the God.

Relationship between “Human “ and “Humidity”

- Are there any relationship between the words, “Human “ and “Humidity” ?
- From 50% (adults) to 80% (baby) of human body is composed of water.

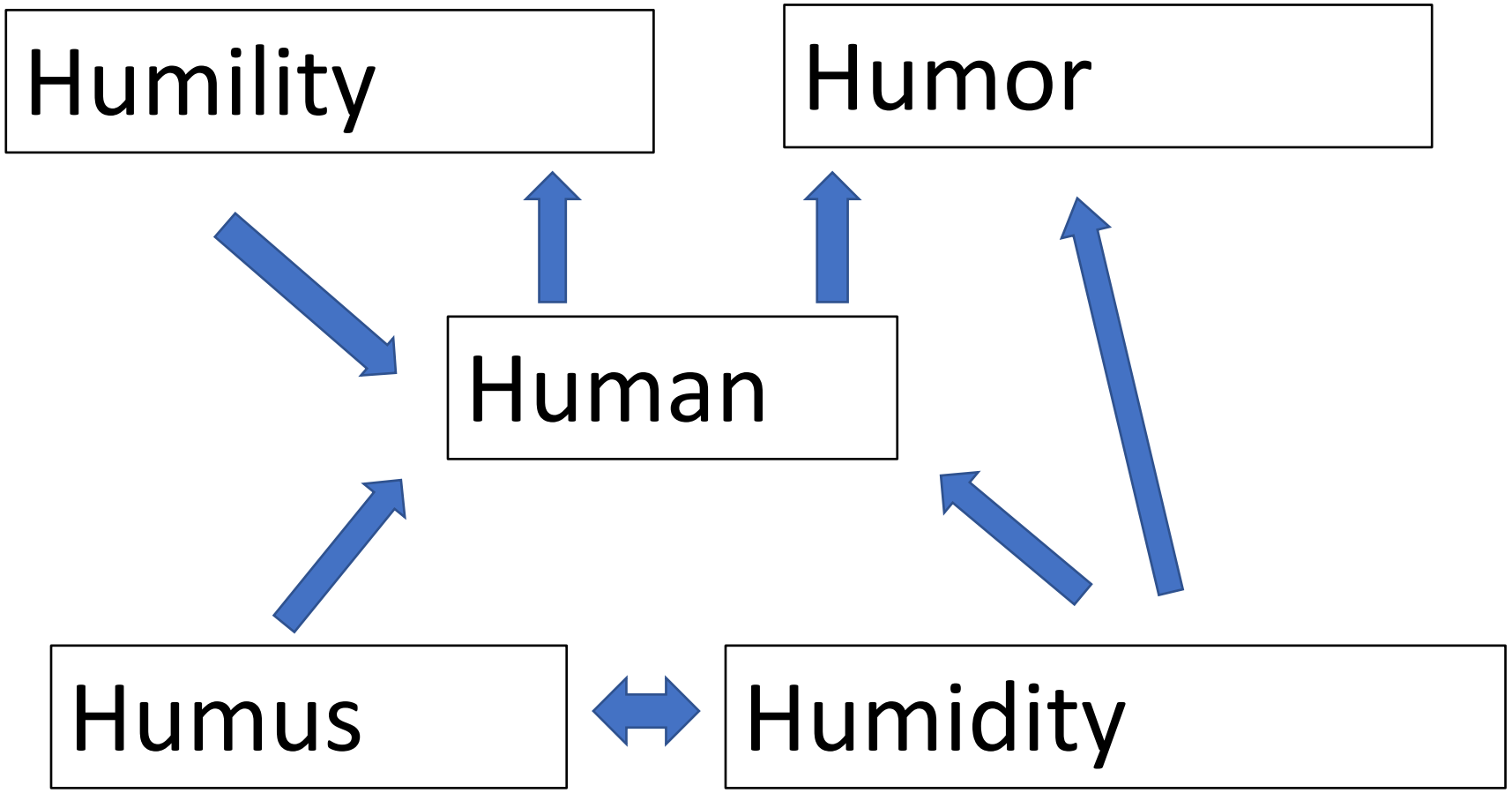
“Humor “

- In Latin word, moisture is called “umor”.
- They considered that the liquid in human is related to the spirit and disposition of human.
- Now, “Humor”, “Humidity” and “Human” could be related each other.

“Humility”

- “Humility” is a spiritual attitude of Human to make himself (herself) a proper (honest) human.
- To recognize the limit of each human.
- By Ms. Michiko Inukai, (1983) “Terra of human”.

Relationships between the words crowned by “Hum”



How soils were formed?

- Rising up (upheaval) of land, formation of new land by regression of the sea. → River terrace
- Transportation and accumulation of soils.

→ alluvial plain and fan.

- Volcanic ash, pumice, rock, and lava.
- Accumulation of loess (soil dust from the desert or glacial deposit).

How soils were formed? (2)

- Deposit of glacier → moraine
- Accumulation of peatland plants
  → Low, medium, and high moor peat.
- Land reclamation
- Farmland development, cutting and depositing the land to improve the undulated land shape.

Deposit of stones left by the glacier: (Moraine)

Sarobetsu wetland in Hokkaido, and the Rishiri island.

View of Kushiro wetland in Hokkaido.

Reclaimed land in Hachiro lake, Akita, Japan

Hachiro lake before reclamation.

Hachiro lake after reclamation.

Soil and Civilization

Soil is the most important environmental factor breeding the civilization.

Local names for soils in Japan

- Masatsuchi
- Matsuchi
- Kuroboku
- Onji
- Shirasu
- Boratsuchi
- Kanuma-tsuchi

Various places

Volcanic ash and pumice

- Don-don heiya
- Tokachi bozu
- Bake tsuchi

Hokkaido

- Shiro-bane
- Sabatsuchi
- Goro-tsuchi
- Sukumo peat

Aichi

Local site names in Ainu language related to soils

Hiroo：Toyoibetsu (soil river)

Toyokoro：Toitokki, Toh-Etoku (The place where marsh ends)

Shakotan, Tokoro：Chietoi-nai (edible soil stream)

Honbetsu：Chietoi (Edible soil)

Urahoro：Chietoi ushi (the place of edible soil)

Kameda：Chietoibetsu (Edible soil river)

Urakawa：Retara toi (white soil)

Shizunai：Toibetsu (soil river)

Rikubetsu：Yukuepira（The cliff where deer eats soil）

Four patterns from the birth to the death of soils

- Humid cool climate type
- Humid temperate climate type
- Dry climate type
- Glacial climate type

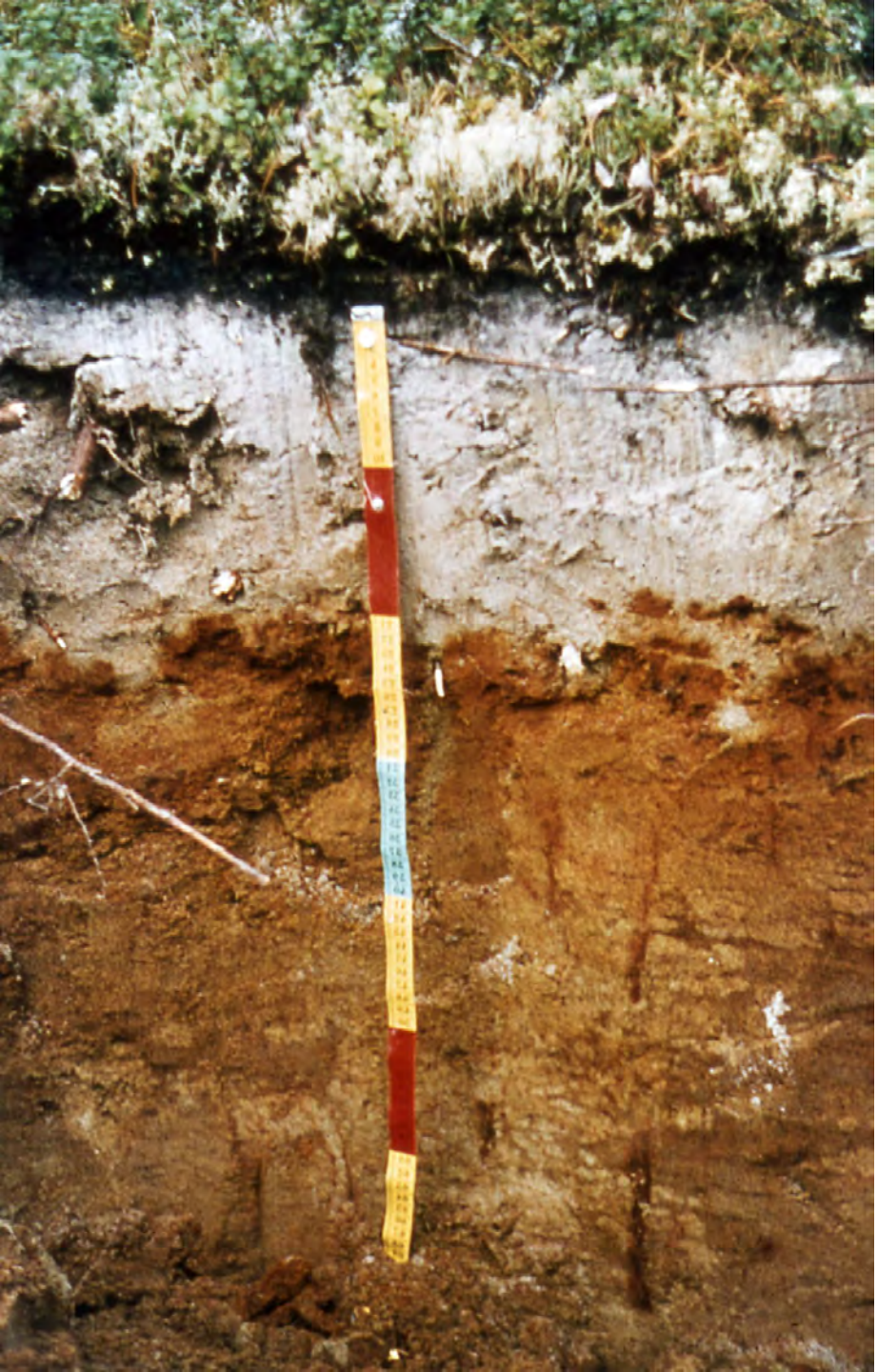
Fujiwara (1991)：Soil and the Japanese ancient culture

The relationship between human and soil

- Human is benefitted from the soil only during the limited period of its process from the birth to its death.
- The relationships can be observed between the civilization or culture and the soils in various places in the world, for example ….
- Slash and burn, and rice cultivation culture in Asia.
- Hunting culture in Europe.
- Oasis culture in the desert.

Soil formation under humid cool climate

- Podzol soil weathering
- Occur in the cool and boreal conifer forest vegetation band.
- Silicate remains and accumulates in soil.
- Soil bases, oxidized iron, oxidized aluminum, and organic matter are leached and accumulate in the sub soil layer.
- Soil becomes extremely acidic.



Ferric Podzol:

(Iron podzol)

Other Podzols in which the ratio of percentage of free iron to percentage of carbon is 6 or more in all subhorizons of the B horizon

No. 47,
Ferric Podzol,
Ferrod,
in Vindeln, Sweden

Soil formation under humid temperate climate

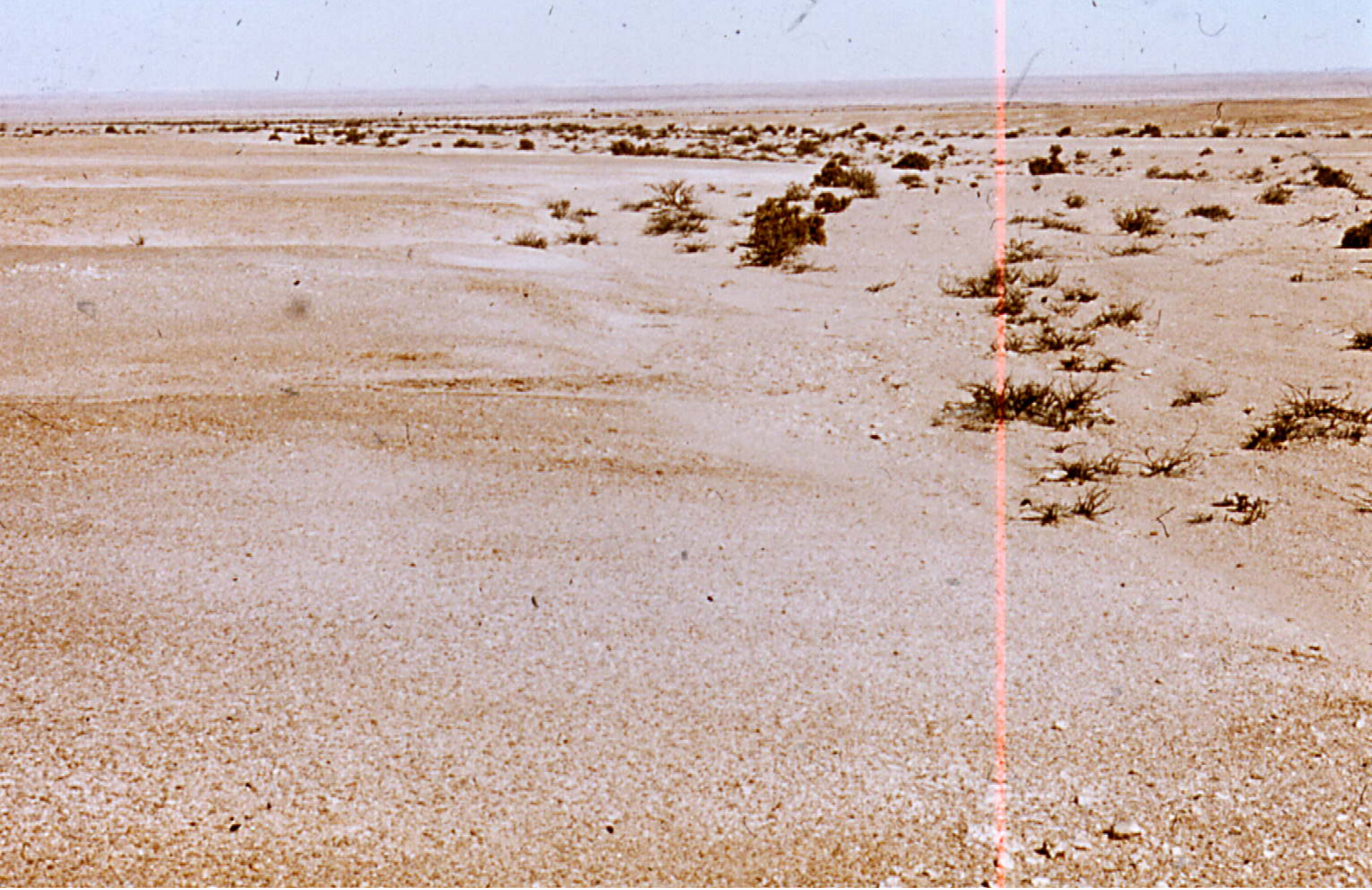
- Latosol weathering
- Weathering under high temperature and heavy rain condition
- Silicate and base are both leached.
- Oxidized iron and aluminum remain and accumulate.
- Soil is acidified.

Deeply weathered iron alumina soil

No. 61,
Deep weathering down to 18 m in Orthic Ferralsol site

Soil formation under dry climate

- Desert soil weathering
- Under high temperature and little rain condition
- Mechanical weathering prevails.
- Soil base and salts remain and accumulate.
- Alkaline soil formation



No.20, Gypsic Yermosol, Petrogypsic Gypsiorthid,
in Namib desert

No. 19, Gypsic Yermosol, Petrogypsic Gypsiorthid, in Namib desert

YERMOSOLS (Y): Other soils having a very weak ochric A horizon and an aridic moisture regime

Glacial climate

- Mechanical destruction of rocks by ice and snow.

Soil and culture

- Podzol soil culture
- Brown forest soil and volcanic ash soil culture, slash and burn
- Red yellow soil culture: Slash and burn culture transferred through the east china sea (Ever green forest culture)
- Latosol culture
- Coral and lime stone soil culture
- Grassland soil culture
- Oasis soil culture
- Yellow soil culture in China
- Paddy soil culture in Japan

Stone・Sand・Mud

Bases of different civilizations in the world

Kenichi Matsumoto

Civilizations of sand, stone, and mud （PHP books）

Civilization of mud （Shincho books）

Civilization and Culture

- Civilization

  The mode of human life accompanying the formation of city, citizen, and nation.

- Culture （common to agriculture）

  Mental activity of human in a high dimension depending on the history of folks and climate.

Both civilization and culture

Are not based on the inherent nature of the human, but depend on the education state, knowledge, moral, and the ability of literacy acquired in the society.

Civilizations of sand, stone, and mud

- Stone：Europe（Christianity）

- Sand：Desert area in the far east
  （Islam, Civilization of oasis and trading）
- Mud：Asia
  （Buddhism, Hinduism, Polytheism, Civilization of paddy agriculture）

Civilization on Sand

- Civilization born on the barren land.
- Trades in oasis
- Communication and contract are important
- Network is strong
- Monotheism

The remain of ancient Roman city in Lybia

Civilization on stone

- Civilization evolved on the basal rock remained by glacial movement.
- Male supremacy （The god is male）
- Large area is necessary for animal grazing.
- Always seek for new lands.
- The force expanding to outside

  （The same tendency in Spain, England, and America）

The view of Aran Island

Rock is crushed, and sea weeds are incorporated to make field soil for growing potato.

Civilization on mud

- Evolved in a fertile monsoon area.
- Abundant living activity is bred by the mud.
- Polytheism（Buddhism, Hinduism, Shintoism）
- The female line society
- Equality between man and woman
- Ability turning inward

Civilization on mud (2)

- This civilization is most filled with vital energy.
- Earthen ware was first invented in this civilization.
- Mud is also used for the construction material for houses.
- Muddy land has a very high producing capacity, and can support large number of population.

Rice terrace in Yaotsu,
Gifu prefecture

Paddy field in Khon Kaen, Thailand

Reclaimed paddy field in Hachiro lake in Akita

What will be the future of soils in modern agriculture ?

- Will the conservation of soils be respected in the international competition and seeking for the profit ?
- Can the agriculture requiring large labor power though it may be soil friendly be competent with the performance oriented agriculture ?
- How far can we depend on pesticides, chemical fertilizers and genetically modified seeds ?