Astrogeology 03 **Professor Merguerian**
Hofstra University **Geology Department**

Planetary Geological Timescales

MERCURY (No Geochronologic data; absolute ages unknown)

KUIPERIAN PERIOD
========== ~1.0 Ga
Young rayed craters such as Kuiper form

MANSUARIAN PERIOD
========== ~3.0 – 3.5 Ga
Period of diminished cratering

CALORIAN PERIOD
========== ~3.85 Ga
Smooth lowland plains volcanic units (Suisei, Odin, Tir Planitias) flow onto surface
Caloris Basin impact and lineated terrain
Planetary shrinkage event results in lobate scarps (syn- to post-Caloris age)

TOLSTOJIAN PERIOD
========== ~3.9 – 4.0 Ga
Tolstoj Basin impact and large highland craters form

PRE–TOLSTOJIAN PERIOD
========== ~4.0 – 4.2 Ga
Intercrater highland plains unit and obliteration of oldest craters
Extensive global volcanism and resurfacing during cratering
Major differentiation yields core and planetary expansion
Accretion
========== Mercury Forms ========== 4.6 Ga

VENUS (No Formal Systems Named)

========== ~0.75 Ga
Isolated volcanic constructs erupt through plains units forming coronae in equatorial regions
Planetary resurfacing with global lava floods in flat lowland plains and tesserae
Isolated surface deformation producing locally fractured crust (Tesserae)

========== Venus Forms ========== 4.6 Ga

EARTH

CENOZOIC ERA

========== 0 Ma

Pleistocene glaciation
Mammals dominate
Alpine orogenesis

MESOZOIC ERA

========== 66 Ma

Age of the reptiles including the dinosaurs
Nevadan orogeny affects western Cordillera
Rifting and opening of modern Atlantic Ocean

PALEOZOIC ERA

========== 245 Ma

Age of early life - marine invertebrates thrive in vast epeiric oceans
Antler and Sonoman orogenies affect west coast of North America
Taconic, Acadian, and terminal phase Appalachian orogenies affect east coast of North America which results in creation of Pangea

PROTEROZOIC EON

========== 570 Ma

Modern-type sediments and sedimentary rocks flourish
Banded-iron formations
First glaciation on earth

ARCHEAN EON

========== 2.5 Ga

Algoman Intrusive episode at 2.5 Ga - worldwide intrusion of granitoid magmas
Early continental nucleii form with rapid tectonics - formation of greenstone-gneiss terranes
Oldest life forms (procaryotes) found in old rocks
Oldest crustal rocks ~3.98 Ga preserved in Canadian shield

HADEAN EON

========== 4.0 Ga

Earth largely molten and receiving beaucoup impacts

========== Earth Forms ========== 4.6 Ga

EARTH'S MOON

COPERNICAN PERIOD

========== 0 Ma

Formation of crater Tycho ~ 200 Ma
Formation of crater Copernicus ~ 800 Ma

ERATOSTHENIAN PERIOD

========== 1.1 Ga

Limited basaltic volcanism (~2.1 Ga)
Decreased cratering (<late Imbrian rate)
Basaltic lavas flow into Oceanus Procellarum and Imbrium Basin (~3.2 Ga)

IMBRIAN PERIOD

========== 3.2 Ga

Flooding of multi-ringed craters eventually covering 17% of lunar near side
Impact cratering decreases to 1.5% of Nectarian rates

========== 3.8 Ga

Formation of Imbrian and Orientale Basins

NECTARIAN PERIOD

========== 3.95 Ga

Formation of 10-12 huge multi-ringed basins

PRE-NECTARIAN PERIOD

========== 4.05 Ga

Intense cratering with formation of ~30 multi-ringed basins including Procellarum and south polar Aitken basins
Anorthositic lunar crust forms during crystallization of magma ocean
Moon forms by Mars-sized impact with proto-Earth, hurling pre-lunar materials into near-Earth orbit

========== 4.6 Ga

MARS

AMAZONIAN SYSTEM

========== 0 Ma

Climatic oscillations result in water lakes, ice formation and ice rafts ~ 5 Ma or less
Ice sheets form then melt away forming water floods
Youngest Tharsis and Olympus lava flows
Youngest landslides in Valles Marineris

========== 225 Ma

Volcanism in Tharsis and Olympus Mons regions
Lava flows in northern plains
Landslides in Valles Marineris

========== 700 Ma

Waning of global tectonism and volcanism
Volcanism at Tharsis District, Alba Patera, Elysium region (~2 Ga)
Olympus Mons attains present size
Voluminous basaltic lavas in northern plains

========== 3.55 Ga

HESPERIAN SYSTEM

========== 3.55 Ga

Waning of tectonism, faulting, and rifting in and around Tharsis District
Major volcanism in Tharsis District and at Alba Patera, Tempe Terra, Syria Planum, Elysium Planum areas
Development of outflow channels during catastrophic water floods

========== 3.7 Ga

Major rifting in Valles Marineris, Noctis Labyrinthis
Basaltic volcanism in northern plains continues
Central volcanic eruptions at Alba Patera and highlands paterae
Development of fretted channels

========== 3.8 Ga

NOACHIAN SYSTEM

========== 3.8 Ga

Meteorite flux decreases
Intense erosion and development of runoff channels
Basaltic volcanism in highlands and plains
Faulting in Tharsis region

========== 3.95 Ga

Waning of meteoritic impacts
Faulting in southern Tharsis region
Formation of northern lowlands
Intense meteorite bombardment with large craters formed (Isidis, Hellas, Argyre, south polar multi-ringed basins)
Shutdown of Martian magnetic field

==========Mars Forms========== 4.0 Ga