How to cite this document:

Naṣīr al-Dīn al-Ṭūsī. *al-Risāla al-Muʿīniyya*, book 3, chapter 1. In F. Jamil Ragep, Fateme Savadi, Sajjad Nikfahm-Khubravan. *al-Risāla al-Muʿīniyya (al-Risāla al-Mughniya) and its Supplement*. Vol. II, *English Translation* (Tehran: Mirath Maktoob), 99–107.

BOOK III

On the Configuration of the Earth, and the Variability of the Circumstances of
Locations on It with Respect to the Changing Positions of the Upper [Bodies]

CHAPTER ONE

On the Configuration of the Earth, and a Brief Exposition of Its Circumstances

[1] We have said previously that the Earth is spherical in shape, and is situated in the middle. Thus, its center is the center of the World and the center of heavy bodies. Circular motions are around it, and rectilinear motions are toward it or away from it.

[2] If it were not for heavenly causes necessitated by Divine providence—grand be His praise—water would surround the [Earth] completely, because earth is heavier than water and no part of the Earth would be uncovered. However, due to certain causes ordained by the Creator—grand be His name—it was necessitated that some of its surface be uncovered and adjacent to the air so that animals dwell on it. Water and earth are mingled, and altogether have become analogous to one sphere.

[3] Some scholars have said that the reason part of the Earth's surface is uncovered is that the Sun is closer to the Earth in the south and farther away in the north, since the Sun's apogee is in the north and its perigee in the south. When it is closer, its body appears larger and therefore its rays are stronger and its heat, necessitated by its rays, is more. [Now], it is the characteristic of heat to draw wetness to itself, as can be observed in a lamp when it draws oil to itself. Therefore, the excess of heat in the south draws water in that direction so that the northern side is left uncovered. On this basis, as the apogee of the Sun is displaced from one direction to another, the settled world will move too. Although this argument is satisfactory for explaining the reason why the northern hemisphere is characterized by settlement, it is not satisfactory for [explaining] why one of the two northern quarters is characterized by [settlement] rather than the other—and knowledge is with God.

[4] In general, the part of the Earth that is uncovered is considered to be about one quarter and is called the populated quarter. This quarter is not completely settled, but rather within this quarter there are seas in its localities and around them, as well as deserts and mountains, and some locations that are too hot or too cold for the human race to live there.

[5] As the equinoctial circle divides the visible surface of the Earth into two halves, a circle will occur on its visible [surface] that is like an equator for the terrestrial sphere. That circle is called the equator and divides the Earth into two hemispheres, one northern and the other southern. If another circle is imagined that is at right angles to the first circle and passes through the two poles of the first circle, each half is then divided into two halves. Each of these four divisions is then a quarter of the surface of the Earth. The populated quarter is one of the two northern quarters.

[6] The length of each quarter is half a great circle, and its width is one
quarter. Now if two persons were to stand upright at the two extrem-
ities of the populated quarter, they would be at either end of a diame-
ter of the Earth, and their feet would be aligned with each other; both
would have one horizon circle. However, the visible half of the [celes-
tial] orb would be the invisible half for one of them, and the visible half
for the other. Then, if one divides each of these [two] circles in accor-
dance with the celestial degrees, the length of the populated quarter
will be 180 degrees and its width 90 degrees. Of this 90 degrees, the
amount up to the complement of obliquity, which is 66 degrees and a
fraction, has the possibility of habitation. Beyond that up to 90 degrees
cannot be inhabited because of the extreme cold due to the distance
of the Sun from the zenith.

[7] Therefore, the length of the settled world is 180 degrees, and its
width is 66 degrees and a fraction. The sea encompasses most of this
expanse, and that sea is called the encompassing sea. Even in the midst
of this settled world there are many seas, some of which are connected
to the encompassing sea, some not connected.

[8] Among those [seas] that are connected, the largest is the Sea of
Oman (ʿUmān), which is also called the Sea of Persia (Fārs) and also the
Sea of India (Hind). It has opened [a passage] through the land from the
east to near the western boundary. The connection of this sea to the
encompassing [sea] is in the east. The length of this sea from the east
to where it reaches the western boundary is 2,660 parasangs, and its
width is 900 parasangs, 330 parasangs of which is north of the equator,
and the rest is to the south. The equator passes through most of this
sea.

[9] Four inlets of this sea extend into the middle of the [settled] world:

[10] The first, which is in the west, is called the Gulf of Barbary (Bar-
bar), which is at the border of the Barbary. The length of this inlet in

the north is 160 parasangs, and its width is 35 parasangs.

[11] The second inlet is called the Red Gulf. Its length in the north is 460 parasangs and its width 200 parasangs. Where it narrows, its width becomes 60 parasangs, and at that point it is called the Sea of Clysma (*Qulzum*). Clysma is a town on the shore. It is also called the Lingua Maris (*Lisān al-baḥr*).

[12] The third inlet is called the Persian Gulf, and Basra (*Baṣra*) is on its shore. Fārs and Kirmān are contiguous to it. The length of this gulf is 460 parasangs, and its width is 180 parasangs. Between this gulf and the Red Gulf is [a distance of] 500 parasangs, all of which is Arab provinces. The Tigris (*Dijla*) and Euphrates (*Furāt*), which come from the mountains of Anatolia (*Rūm*) and Syria (*Shām*), spill into this sea. The borderline of this gulf is the land of Sind, and there many rivers discharge into it. There are many islands in this gulf.

[13] The fourth inlet, called the Green Gulf, is in the land of India. It is about 500 parasangs long, and there are great islands in it.

[14] There is another sea, also connected to the encompassing [sea], called the Mediterranean Sea (*daryā-yi Rūm*). Its length, from Andalusia (*Andalus*) toward the east, is 1,600 parasangs. Between the edge of this sea and the Sea of Clysma is [a distance of] three way-stations. Where this sea joins the encompassing [sea], it is no more than three parasangs wide, [but] as it gets farther from the encompassing [sea], it becomes 200 parasangs [wide]. When it reaches the border of Syria, it is 260 parasangs [wide]. Many rivers from Byzantium (*Rūm*) discharge into this sea. Two inlets extend [into the land] from this sea: one is called the Gulf of Constantinople (*Qusṭanṭaniyya*), which is 160 parasangs long; and a second inlet [toward] the west, which is 70 parasangs long. The islands of the Greeks are in this sea. The Nile (*Nīl*) of Egypt, which comes from the south, from the Lands of the Moon, discharges into this sea.

[15] There is another sea, also connected to the encompassing [sea] toward the north, called the Sea of the Varangians [i.e., the Baltic Sea], which is a large sea.

[16] As for the seas that are not connected to the encompassing [sea], the largest is the Khazar Sea, also called the Caspian (*Ābiskūn*) Sea. Its length, from east to west, is 260 parasangs and its width is 200 parasangs. Several large rivers discharge into it, such as the Arax (*Aras*) River, which flows from Armenia; the Kura (*Kur*) River; the Volga (*Itil*) River, which comes from the region of the Bulgarians (*Bulghār*) and is larger than the Oxus (*Jayḥūn*); and the river called Sipīd-rūd.

[17] The other [unconnected to the encompassing sea] is the Aral Sea (lit., Khʷārazm Lake), into which discharges the Oxus of Khʷārazm, flowing from east of Balkh and [formed] from the conjunction of five large rivers, and the Jaxartes (*Sayḥūn*), which comes from Turkistān. The perimeter of this sea is 100 parasangs. Between it and the Caspian Sea is [a distance of] twenty way stations.

[18] In Syria there is a small sea called the Sea of Tiberias (*Ṭabariyya*), the size of the Aral Sea or smaller. In Armenia there is a lake in the area of Manzikert (*Malāzjird*). In sum, the details of the seas are numerous, and some of them are described in the books of roads and kingdoms (*masālik wa-mamālik*). This has been a general account of the populated quarter.

[19] Of the deserts, the Arabian Desert, the Maʿbad Desert and the Khʷārazm Desert are quite well known. There are also other deserts, for on the periphery there is less settlement and more deserts.

[20] In his book *Geographia*, Ptolemy determined the width of the inhabited world to be $79 + \frac{1}{4} + \frac{1}{6}$ degrees and said that of this total $16 + \frac{1}{4} + \frac{1}{6}$ degrees is south of the equator, and 63 degrees is north [of it]. He determined the length of the settled world to be $177 + \frac{1}{4}$ degrees. He said that there is more mention of northern habitations because this

is most of the settlement.

[21] The rationale for taking the starting point of the settled world with regard to longitude from the west is because the zodiacal sequence is this way. Ptolemy considered the beginning of the settled world at the Eternal Isles, which are islands in the Western Sea that were formerly settled. Some consider the beginning of the inhabited world at the shore of the Western Sea. There is a 10-degree difference between the two.

[22] The beginning of the settled world with regard to latitude is considered to be the equator. What lies to the south is said to be southern in latitude, and what is to the north is said to be northern in latitude. The positions of given localities are determined by longitude and latitude. Thus, the longitude of a given locality is an arc along the equinoctial between the meridian circle of either the Eternal Isles or the shore of the Western Sea and the meridian of the given locality. Hence, it is obvious that the farther one goes toward the north, the less the length of longitudinal degrees becomes, until at one point that is aligned with the [celestial] pole they all come together. The greatest length [of longitudinal degrees] is at the equator, because the meridian circles coincide with the declination circles. The latitude of a locality is an arc along the meridian [circle] between the equinoctial and the zenith of that locality. The length of latitudinal degrees is the same everywhere. Every locality whose longitude is less than 90 [degrees] is western, every [locality] whose longitude is greater than 90 [degrees] is eastern. Every locality whose latitude is less than 33° 12′ is southern, and any [locality] whose latitude is greater than this amount is northern.

[23] The Earth is divided into seven climes in width, such that the length of each clime is from east to west. Its width is an amount [that results] in a difference of half an hour in duration of daylight, ex-

cept for the beginning of the first clime and the end of the seventh clime, which are more than this amount because there is less settlement there.

[24] The beginning of the first clime is the equator. The equator starts from the south of western Sudan and passes north of the mountains known as the Mountains of the Moon, and north of part of the Zanj regions and the south of the harbor of Aden, and so on and so forth until [it reaches] Sarbuza Island, which is in the Green Sea, and the islands of Sarandīb to Dizkank, which is reckoned as [part of] China. The limit of the equator is at an island the Indians call Jamkūt. The midpoint of the equator is called the Cupola of the Earth. The midpoint of the first clime is where its latitude is 16° 27′ and its daylight is 13;0 [hours]. Among the localities of the first clime are western Sudan, part of the Barbary lands, Yemen, the lands of Abyssinia and the Zanj, and the Indian Islands to the border of China.

[25] The beginning of the second clime is where its latitude is 20°14′ and its day is 13 [hours] and 15 [minutes]. Its midpoint is where its latitude is 23°51′ and its day 13 [hours] and 30 [minutes]. Among the localities of this clime are parts of Egypt, Barbary and the Maghrib, most of the lands of the Arabs, Ḥijāz and Yemen, a side of Mukrān and Sind, and most localities of India.

[26] The beginning of the third clime is where its latitude is 27°12′ and its day is 13 [hours] and 45 [minutes]. Its midpoint is where its latitude is 30°22′ and its day is 14 [hours] and 0 [minutes]. Among the localities of this clime are parts of the lands of the Maghrib, Barbary and Ifrīqiyya, Alexandria, part of the lands of Syria, the Jazīra, Kūfa, Baṣra, Baghdād, most of Iraq of the Arabs, Ahwāz, Fārs, Kirmān, Sijistān, Zābul, Kābul, part of Indian lands, and a side of the Turkic [lands] and China.
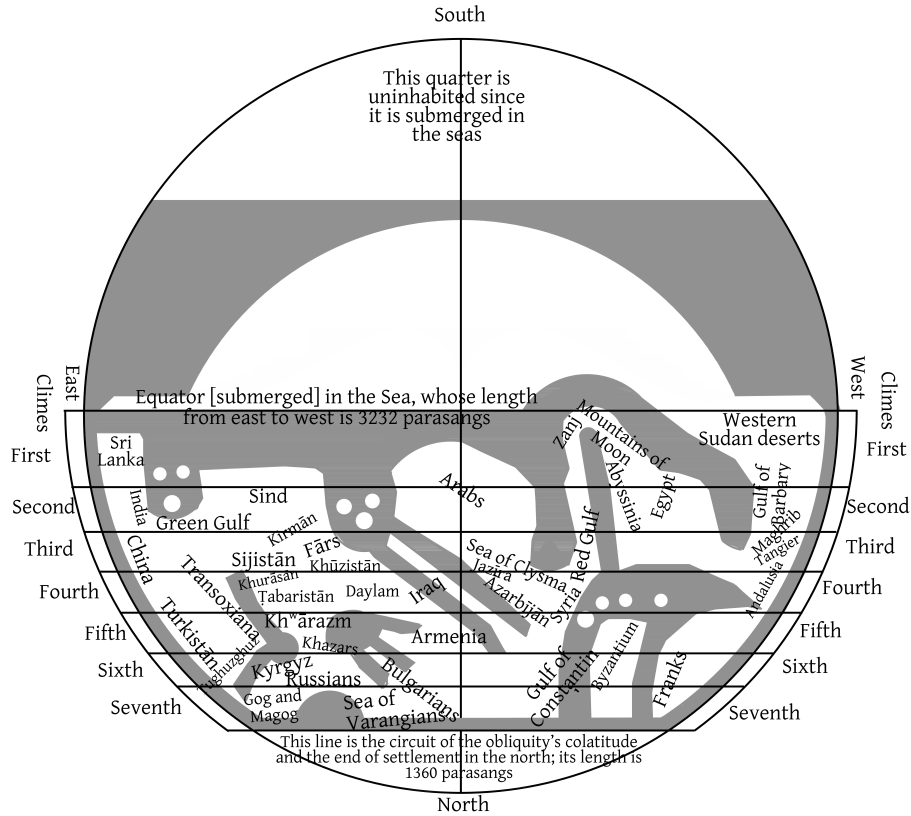
[27] The beginning of the fourth clime is where its latitude is 33°18′, and its day is 14 [hours] and 15 [minutes]. Its midpoint is where its latitude is 36°0′, and its day is 14 [hours] and 30 [minutes]. Among the localities of this clime are the lands of Andalusia, parts of the Maghrib, Anatolia, and Syria, most of Azerbaijan, the lands of Jazīra, Mosul, the towns of Iraq of the Persians, Qūmis, Daylam, Ṭabaristān, Gurgān, Khurāsān, Gīlān, Tibet, and a side of the Turkic lands.

[28] The beginning of the fifth clime is where its latitude is 38°35′, and its day is 14 [hours] and 45 [minutes]. Its midpoint is where its latitude is 40°56′, and its day is 15 [hours] and 0 [minutes]. Localities in this clime are part of Byzantine lands, Armenia, Khazar, Khʷārazm, Transoxiana, Farghāna, and part of the lands of Turkistān.

[29] The beginning of the sixth clime is where its latitude is 43°51′, and its day is 15 [hours] and 15 [minutes]. Its midpoint is where its latitude is 45°0′, and its day is 15 [hours] and 30 [minutes]. Localities of this clime are most of Byzantium, Khazar, Turkistān, and the lands of various [Turkic] groups.

[30] The beginning of the seventh clime is where its latitude is 46°51′, and its day is 15 [hours] and 45 [minutes]. Its midpoint is where the latitude is 48°32′, and its day is 16 [hours] and 0 [minutes]. Its end is the end of settlement. Localities of this clime are the lands of Slavs, the boundaries of the Turks, and Gog and Magog. In some of these localities it is so cold that its people have to spend six months in bathhouses.

[31] Some people place the beginning of the first clime where its latitude is 12°30′, and its day is 12 [hours] and 45 [minutes], and the end of the seventh clime where its latitude is 50°0′, and its day is 16 [hours] and 15 [minutes]. What lies above or below these places is not reckoned in the climes. This is the illustration of the Earth:

South

This quarter is
uninhabited since
it is submerged in
the seas

East | Climes — West | Climes

Equator [submerged] in the Sea, whose length
from east to west is 3232 parasangs

Western
Sudan deserts

First

Sri
Lanka

Sind

Arabs

Zanj
Mountains of
Moon
Abyssinia
Egypt

Gulf of
Barbary
Maghrib
Tangier

Second

India
Green Gulf

Kirmān

Fārs

Sea of Clysma
Jazīra
Azarbijan
Syria Red Gulf

Andalusia

Third

China

Sijistān
Khurāsān
Tabaristān Daylam
Khūzistān
Iraq

Fourth

Transoxiana
Khᵂārazm
Khazars
Armenia

Gulf of
Constantin
Byzantium
Franks

Fifth

Turkistan
Ghuzz
Kyrgyz
Russians
Bulgarians

Sixth

Gog and
Magog
Sea of
Varangians

Seventh

This line is the circuit of the obliquity's colatitude
and the end of settlement in the north; its length is
1360 parasangs

North

West | Climes
First
Second
Third
Fourth
Fifth
Sixth
Seventh

[Figure 1]

CHAPTER TWO

On the Characteristics of Localities That Are on the Equator

[1] In localities that lie on the equator, the equinoctial circle passes through the zenith; the intersection of the equinoctial and the horizon is at right angles; the equinoctial and the circle of the initial azimuth [prime vertical] are the same circle; and two poles of the equinoctial are on the horizon. The horizon circle bisects the day-circuits into two halves, one visible half and one invisible half. No part of the [celestial] orb is permanently visible or permanently invisible, but [the period of] invisibility of each part is equal to [the period of] its visibility. The ro-