This is a map from the “Balkhi School of Geography” (a.k.a. the KMMS tradition) that possesses climate boundaries. This particular map is a very late map (ca. 1413) from a Timurid scientific manuscript. It was obviously drawn with special care, and the climates are spaced so that the southern ones are wider than the northern ones and the boundaries are straight lines due east and west. The southern edge of the Indian Ocean follows the southern boundary of the first climate (presumably the Equator, though not labeled as such and appearing well to the south of the world circle. A Ptolemaic feature occurs in the mountains at the source of the Nile. The map itself has all the features of the Istakhri I map (#211), although it has only two islands in the Mediterranean, but is unusual in having detailed nomenclature in the Persian area and only selected material in the rest of the world. Measuring 35.5 x 48 cm, the map is done in opaque watercolor, ink and gold on paper.

Abu Zayd Ahmad ibn Sahl al-Balkhi was a Persian Muslim polymath: a geographer, mathematician, physician, psychologist and scientist. Born in 850 CE in Shamistiyan, in the province of Balkh, Khorasan (in modern day Afghanistan), he was a disciple of al-Kindi. He was also the founder the “Balkhi school” of terrestrial mapping in Baghdad which Karen Pinto has re-named the “KMMS tradition”. He died 934 A.D. He was a scholar whose background, though not his geographical work, was well known in the Arab literary community. His work, according to al-Muqaddasi, was mainly a short commentary on a set of maps, though other opinions state that al-Balkhi’s work was the commentary and the maps were originally produced by Abu Ja’far Muhammad ibn Muhammad al-Khazin (died between 961 and 971). It is all very suspect, however, since neither al-Khazin’s maps nor even the commentary of al-Balkhi, which was entitled Suwar al-aqalim [Pictures of the Climates], have survived—only some of the earlier portions of al-Istakhri’s text can possibly be thought of as originating in the book of al-Balkhi. Al-Balkhi was primarily a general scholar and not necessarily a geographer. His life is known from the standard biographies. He was born and lived at the end of his life in Balkh in northeastern Iran, where he was supposed to have written his geographical treatise. Most of his life, however, he spent in Baghdad and Iraq, where his scholarly connections mostly belong.

The maps accompanying these texts seem at first sight to be a not entirely necessary supplement to the texts, the text being so complete in itself. This is often so with illustrative material in classical Arab texts, certainly with maps in some later geographical works. Some manuscripts have no maps at all, and some have spaces left for them in the text, though none have been inserted. However, there is every evidence that these authors were definitely, if not primarily, interested in the maps and designed their own maps even if they did not draw them themselves. According to al-Muqaddasi, al-Balkhi “intended in his book chiefly the representation of the earth by maps.... He described each map [only] briefly without giving useful particulars or setting forth clearly or in order the facts which were worth knowing.” He also states that al-Balkhi’s book is “a book with very carefully prepared maps, but confused in many places and superficial in its commentaries, and it does not divide the provinces into districts.” This makes it appear that al-Balkhi’s main interest was in the maps, which were the important items while the text was secondary.
The geographers of the Balkhi school also wrote extensively of the peoples, products, and customs of areas in the Muslim world, with little interest in the non-Muslim realms. The "Balkhi school", which included geographers such as Istakhri (#211), alMuqaddasi and Ibn Hawqal (#213), produced world atlases, each one featuring a world map and twenty regional maps. Around that same time, Al-Masudi drew a map of the world where there is a large area in the ocean, southwest of Africa, which he referred to as Ard Majhoola [Arabic for "the unknown territory"]. Some have alleged that Ard Majhoola may be a reference to the Americas, based on a tale he relates regarding the navigator Khashkhash Ibn Saeed Ibn Aswad.

Map historian Konrad Miller has attributed four manuscripts to al-Balkhi, on what grounds is not known. It is known, however, that al-Balkhi significantly influenced subsequent works by Ibn Hawqal and al-Istakhri (#213 and #211), so much so that European scholars refer to the genre as the “Balkhi School of Geographers”. Therefore the “Balkhi School” refers to a group of four authors who recognize the fact that their geographic work is interlinked. It is also known to scholars as the Classical School of Arab Geography or the Islam Atlas. More recent scholars like Karen Pinto have renamed this cartographic tradition as the Ottoman Cluster "KMMS". All the manuscripts in what is called the Ottoman Cluster [al-Istakhri’s Kitab al-Masalik wa-al-Mamalik - Book of Roads and Kingdoms, henceforth KMMS] are written on thin, highly polished paper in tight, late, naskhi script with few diacritical marks. Abu Zaid Ahmad ibn Sahl al-Balkhi, who wrote Suwar al-aqalim, is the earliest of them and presumably the originator. The other three authors are Abu Ishaq Ibrahim ibn Muhammad al Istakhri (#211), Muhammad Ibn Hawqal (#213) and Abu Abdallah Muhammad ibn Ahmad al-Muqaddasi.

Their work is based on a series of maps covering the Islamic Empire together with a text that consists mainly of notes on the maps. Many copies of these works survive; the earliest surviving manuscript being a version by Ibn Hawqal dated 1086. This is the earliest Arabic manuscript to contain a map. Yet, copies of al-Istakhri’s book were still being produced as recently as the middle of the 19th century AD. There is so much material available that scholars have identified two separate editions of al-Isakhri, three of Ibn Hawqal and two of al-Muqaddasi. Although one of the versions of Ibn Hawqal does not contain maps. These different texts can be associated with similar sets of maps, and these maps can be compared and relationships established which enable us to trace the development of “Balkhi” cartography. The standard set of maps consists of one world map, two oceans (Indian and Mediterranean), four Roman provinces (i.e., areas which were originally Byzantine) and 14 Persian provinces.

It is obvious that the maps are conceived as a set covering the Muslim Empire with reasonable detail, and there is no attempt to cover non-Islamic areas in the same way. It has been suggested that this policy of including only Islamic regions is deliberate. Each map is given a page or so of textual description, and each of these descriptions is planned in such a way that lists of routes, towns, mountains, rivers, etc., are given for each province. Thus they bear a certain resemblance to the work of Ibn Khurdadhbihi, although the latter’s work was not accompanied by maps nor did he limit himself only to the Dar al-Islam. There is a likelihood that the Balkhi School material and the work of Ibn Khurdadhbih are based on Persian (Sassanid) materials which survived the Islamicization of the Persian home areas.

The Balkhi maps cannot be connected together like the sectional maps of al-Idrisi (#219) to form one large map of the known world. Al-Istakhri and Ibn Hawqal show no
interest in projection, scale, or mathematical geography and do not mention latitudes and longitudes at all. The only form of measurement given is that of days, journeys (marhala). The maps are very geometrical in design. Lines are straight or arced, rivers are parallel lines, lakes often perfect circles. Towns can be circles, squares, four pointed stars or something similar. Slopping places on routes resemble small tents or caravanserais.

Al-Muqaddasi’s text is based on the same principles but is a considerable improvement over that of his predecessors. He also includes a section on astronomical geography and geodesy including a note on the Greek system of climates. Both Ibn Hawqal and al-Muqaddasi are more up-to-date and are more at home in Europe and North Africa, having a preference for the western pan of the Empire rather than the Persian speaking areas. Al-Muqaddasi’s maps however have a closer affinity with those of al-Istakhri, whereas we would expect, from the nature of his text, something much more advanced. He has however a different selection of maps, there being no world map nor one of the Caspian Sea and a completely new map of the Arabian desert.

The works of these authors were reproduced continually throughout the centuries not only in Arabic but also in Persian or Turkish translation. Other writers occasionally borrow a selection of the maps or an individual map. Some of the later versions are very corrupt and hardly recognizable. A world map derived from this school appears regularly in the works of Ibn al-Wardi (#214.1) and often in texts of al-Qazwini’s (#222) cosmography showing how popular these maps were in the Muslim world.

These geographers/cartographers produced many geographic works in the free academic atmosphere that flourished during the reign of the Buyid Rulers of the ‘Abbasid dynasty (although, to be clear, these scholars received no special sponsorship from the government). These cartographers classified the world systematically by political region. For the first time, they employed geographic boundaries to differentiate one country from another.

Living in the mid-10th century, this new generation of geographers witnessed the gradual breakup of the Islamic world into separate political entities that acknowledged the religious, but not the political, authority of the caliph in Baghdad. Although contemporaries like al-Mas’udi (#212) continued to show a broad interest in the world including China, the Balkhi School of geographers focused their agenda on the task of giving a full and detailed account of the Islamic regions, which they believed were most important and about which they received reliable information. Although the Balkhi scholars did not write about the non-Islamic world extensively, their works suggest a basic interest in the world and understanding of it. They mapped the entire known world, including China, before they composed regional geographic treatises and maps comparing different parts of the Islamic world.

Some contemporaries continued to follow much earlier traditional methods of geography that portrayed the world as a landmass in the shape of a bird with China as its head. For example, the 10th century writer Ibn al-Faqih (flourished 902.) says:

The image of the world consists of five parts: the head, two wings, breast, and tail of a bird. The world’s head is China. Behind China is [a place] people called Wakwak. Behind this [country called] Wakwak are people whom no one except God counts [as one of his creatures]. The right wing is India, and behind India is the sea; behind this sea there are no creatures at all. The left wing represents Khazar [of the Caspian], and behind Khazar are two nations each of which is called Manshak and Mashak. Behind Manshak and Mdshak are Gog and Magog, both of which are nations whom only God knows. The breast of the world represents Mecca, Hijaz [the western shore of
the Arabian Peninsula], Syria, Iraq, and Egypt. The tail represents the land from dhat al-Plumdm [the frontier of Egypt] to the Maghreb [Northwest Africa]. The tail is the worst part of the bird.

At the same time, other geographers including members of the Balkhi School maintained their scientific taste and sought to advance geography beyond this folkloristic method in order to create a more accurate geography of the world.

In fact, the Balkhi School maps became a prototype for most maps made by later Muslim geographers. A ring representing the “Encompassing Sea” surrounds the known world. The map is oriented along a north—south axis, and the south placed at the top in accord with the convention of Muslim geographers. Africa occupies much of the southern hemisphere, and the continent stretches eastward into the band of oceans that Islamic geographers thought encircled the world, with the southern part of the continent being terra incognita. The Arabian peninsula with Mecca is located at the center of the map. China is located at the eastern edge of the northern hemisphere and its coastline in the south lies close to the eastern coast of Africa. Although rough, this is a quite accurate representation of Eurasia and the northern part of Africa as Muslim geographers knew them at that time.

Later Muslim geographers like al-Mas’udi testify to the world map that the scholars under Caliph al-Ma’mun created in the early ninth century. Unfortunately, the map no longer exists. Because the lost map was drawn based on new methods of astronomical measuring and mathematical calculations that were based on the Ptolemaic geographic tradition, it probably focused on presenting places in their accurate longitudinal and latitudinal positions. In addition, it most likely incorporated new theories proposed by al-Ma’amun’s scholars that challenged Ptolemy’s works, including al-Khwarizmi’s conclusion that the Indian Ocean was not an inland sea (as Ptolemy claimed) but connected to the Pacific Ocean. This feature can be clearly seen in the earliest extant Islamic maps, in other words, in the Balkh School maps the Indian Ocean links with the Encompassing Sea that surrounds the known world. Except for this new feature, other features of the Balkhi School maps resemble reconstructions of Ptolemy’s longitudinal and latitudinal coordinates. All this evidence suggests that the earlier maps based on the Ptolemaic tradition under `Abladsid sponsorship continued to influence later geographic and cartographic works such as those made by the Balkh School.

Despite their reliance on precedent, the Balkhi School geographers of the 10th and 11th centuries certainly incorporated new features and updated information in their geographic and cartographic works. Breaking from the tradition that simply arrayed place-names according to the longitudinal and latitudinal coordinates, Balkhi School cartographers created the first maps to portray physical features such as mountains and rivers, a feature that would influence later maps. Although they did not draw their maps from firsthand observation, these geographers reported that they consulted travelers, sailors, and sea captains about the geographic features of distant regions and seas that they plotted and described. For example, al-Muqaddasi, a Balkhi School geographer who set the methodological foundation for the development of Islamic geography, says:

Thus I became acquainted with men of standing who were born and bred there — shipmasters, cargo masters, coastguards, commercial agents, and merchants — and I considered them among the most discerning people with regard to this sea and its anchorages, its winds, and its islands. I questioned them about it, about the conditions on it, and about its limits. I also noticed navigation instructions in their possession, which they study together carefully and on which they rely completely,
proceeding according to what is in them. From these sources I took copious notes of essential information, after I had studied them and evaluated them; and this I compared with the maps I have referred to ... I omit anything on which there is disagreement, and include only that on which there is complete accord.

This episode shows how the geographers tapped new information circulating among merchants and travelers in order to update the geographic and cartographic works they published for a broader readership. As a member of the Balkhi School who concerned himself more with the Islamic lands than the wider world, al-Muqaddasi did not include China in his detailed regional maps. However, he does give the Sea of China, which earlier writers identified as the seventh sea to the east, a prominent role in his portrait of the Indian Ocean. Although it was outside the Islamic world, China lay within the Muslim geographer’s realm of knowledge about the world.

On surviving Balkhi School world maps the labels refer almost exclusively to regions or provinces. The world maps of the Balkhi School, as noted by the historian of Islamic cartography Gerald Tibbetts, are “an arm-chair attempt to see all the provinces set down relative to each other”. For this reason, the surviving world maps of al-Istakhri and Ibn Hawqal carry labels designating the Islamic provinces, which are then illustrated in detail in the accompanying regional maps. Moreover, in the Balkhi School, the delineation of the non-Islamic kingdoms is restricted to the world map, and plays no role in the rest of the treatise or maps. In this kind of non-plotted world map, which aims to give only a general overview of the landmasses, there is no place for individual localities such as cities. World maps with labels primarily designating regions rather than cities are also typical of later non-plotted maps, such as those of al-Idrisi (#219) and others. Such maps differ substantially from plotted maps, where the emphasis is on the location of individual cities.

Early Islamic scholars knew that the world is a sphere, and as they assumed that only one hemisphere was inhabited, they usually chose to present the Earth as a circle or disc. This was the most obvious way of depicting the globe on the flat surface of a map, given that the other hemisphere was nothing but water. The world maps of the Balkhi School are shaped as circles, and so are practically all the non-plotted world maps in the later Islamic tradition. A notable exception is an oval world map in a late recession of Ibn Hawqal copied in 1445. This unique oval world map differs markedly from other Balkhi School maps.

The maps of the so-called Balkhi School do not contain projections, coordinates, or grids. They depict the world as a whole, and regions of the Islamicate realm with stylized circles, ovals, triangles, rectangles, and lines representing oceans, lakes islands, mountains, regions, cities, and routes between major cities and postal stations. Its main representatives are the maps attributed to Abu Zayd al-Balkhi, Abu Ishaq al-Istakhri, Ibn Hawqal (d. 380/990), and with some modifications, also those of al-Muqaddasi (d. c.390/1000). Gerald Tibbetts believes that the first set consists of maps only, while subsequent authors added written explanations as well as reports about their own travels. In addition to world maps, the maps of this school depict regions of the Islamicate world between Mà Warà’ al-Nahr (Transoxania) and al-Andalus. The oldest specimen of this type of map is a copy of Ibn Hawqal’s Kitāb sīrat al-arḍ [Book of the image of the world] of 479/1087 (#213), preserved today in the library of the Topkapı Palace, in Istanbul. Karen Pinto severely criticizes Tibbett’s views, presenting her own conflicting claims.
The prevalent scheme of geographical representation in this set of maps is regional. The regions do not represent political entities of the Umayyad or 'Abbāsid caliphates, but rather they seem to combine pre-Islamic Iranian and Roman concepts, without, however, taking those up in all their detail. Standard elements, in addition to regions and routes, are mountains, seas, lakes, and a few major rivers, such as the Euphrates and the Tigris. Sometimes, names of tribes, scientific data such as the circumference of the earth, information about mineral sources, and natural events are also included. A second major feature is the maps’ focus on routes, mostly, but not exclusively land routes, with cities registered as stations along such routes.

Religious and political centers are occasionally highlighted but are not a major category of organization. The main religious feature of the world maps of this class is Mount Qāf, which, according to Islamic cosmography, is the outermost surrounding of the world, separated from terra firma by the encompassing sea (al-bahr al-muhit).

These maps are believed to have had their origin in pre-Islamic Iranian pictorial representations of the seven kingdoms, which formed the inhabited world, depicted as six circles surrounding a central seventh circle. Because the depiction of this scheme in al-Bīrūnī’s Kitāb tahdīd nihāyāt al-āmākin li-tashīh masāfāt al-masākin [Book of the determination of the ends of places for the correction of the distances between habitations] identifies the interior circle with Babylon, suggesting that the scheme’s origin might be in ancient Mesopotamia. There is also speculation about an Indian origin, believing that the inner circle represented Mount Meru.

Al-Bīrūnī’s image leaves, however, no doubt that it presents a substantially modified view of the world. Its distribution of regions through the circles clearly differs from the verbal depiction of an early first/seventh-century source preserved only in Arabic translation, according to which the innermost circle was the seventh kishwar (region) and represented the Sasànian empire A recognizably older version that also places the regions in circles is al-Bīrūnī’s representation of the seven kishvars in his summa of astrology, Kitāb al-taftīm li-āwâ’il sinā’at al-tanjīm [Book of teaching the basics of the art of astrology]. Irānshahr, representing some notion of Iran, alone occupies the centre, and the regions in the circumferential circles are much less detailed and modernized than those in al-Bīrūnī’s other scheme.

The debates continue about the scientific character of world maps and globes produced in the 'Abbāsid caliphate and in the Īlkhānid empire as well as about the relationship between such cartographic products and those created in Christian societies north of the Mediterranean since about 1200. Fuat Sezgin produced a three-volume survey of mainly Western European literature on these issues, in which he also presents his own ideas, often simply asserting claims without providing substantiating evidence or convincing argument. Similarly, Ramon Pujades, using secondary sources exclusively, rejects any impact from Arabic sources on Italian or Catalan portolan charts.

New trends have arisen in the history of cartography, the history of science in Islamicate societies, and Ottoman history. Harley, Woodward, and other contributors to the History of Cartography have abandoned the notion of limiting the map to a mathematically based image of the earth or the heavens and instead extend that notion to include any graphic representation that allows for orientation in space or time. Similarly Emilie Savage-Smith, taking as her starting point the example of Harry Beck’s London Underground Map of 1931, proposes to focus on the functions of the so-called Balkhi maps and to investigate, in light of their functionality, the appropriateness of the tools of representation these maps employ geometrical forms (circles, triangles,
rectangles, squares), colors, straight lines, flowery circular images for toponyms, and so forth, and, in so doing, calling into question whether the denigration often accorded them because of their lack of scientific construction is merited. In contrast, Pinto believes that the symbolic character of these maps is a later development; she considers the fifth/eleventh-century copy of Ibn Hawqal’s work as more mimetic, and thus less symbolic, than later copies. She proposes to abandon the quest for the origins of the Balkhi School and instead to focus research on the extant copies, their properties as artworks, and their audiences.

Art historians and historians of the Ottoman and Mughal empires have made efforts to uncover functions of maps beyond simply providing practical orientation on land or along coasts, and beyond applications of mathematical and astronomical procedures. Pinto considers gift giving between Muslim rulers and royal patronage for Islamic maps in the tradition of the Balkhi School as important elements in Mehmed II’s interest in geography and cartography.

The maps by the Balkhi schools were defined by political, not longitudinal boundaries and covered only the Muslim world. In these maps the distances between various "stops" (cities or rivers) were equalized. The only shapes used in designs were verticals, horizontal, 90-degree angles, and arcs of circles; unnecessary geographical details was eliminated. This approach is similar to that used in subway maps, most notable used in the London Underground Tube Map in 1931 by Harry Beck.

LOCATION: Topkapi Sarayi Müzesi Kütüphanesi, B. 411, fols. 141B-142a, Instanbul.

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*illustrated
Balkhi world map with climate boundaries, 816/1413, 32.9 cm diameter, oriented with South at the top; a KMMS-type stand alone world map in a Persian muraqqa album made for Iskandar Sultan. This world map is unusual for its graticule and its emphasis on cities in Tran and Central Asia. Topkapi Saray Museum, Instanbul, Bagdat 411, fols. 141b-142a.
A map displayed on “Old Manuscripts and Maps from khorasan” by Abu Zaid Ahmed idn Sahl al-Balkhi (850-934), a disciple of al-Kindi and founder of the Balkhi School of terrestrial mapping in Bagdad.

A map shows Iranian traveler Naser Khosrau’s seven-year expedition of 19,000 km from Marv on March, 6, 1046 visiting cities along the Caspian sea, Mesopotamia, Syria, Egypt and ended his journey on October, 23, 1052.