

Rostovtzeff Lectures 2018

The Sky over Ancient Iraq:

Babylonian Astronomy in Context

1 Babylonian Astronomy — Interpreting an Ancient Science

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Lectures 1–4

- 1 Babylonian astronomy — interpreting an ancient science
- 2 keeping the watch: Babylonian astronomical diaries and more
- 3 algorithms, tables and figures: new insights into Babylonian mathematical astronomy
- 4 astronomers, temples, and society: Babylonian astronomy in context

Lecture 1

- 1 ancient Iraq and Babylonian astronomy
- 2 stars, heaven and the gods
- 3 sources in context
- 4 methodological aspects

1 ancient Iraq and Babylonian astronomy



1 Babylonian astronomy – geographical and historical framework



2 stars, heaven and gods: cuneiform representations

2500 BCE



700 BCE



Sumerian Akkadian

an

šamû

sky, heaven

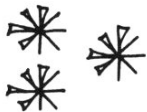
dingir

ilu

god

^dNN

determinative for divine names



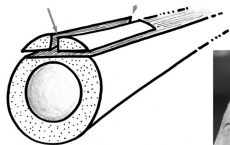
mul

kakkabu

star

mul^lNN

determinative for star names

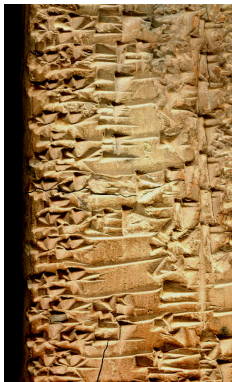


reconstruction of stylus

(M. Cammarosano, 2014, *The Cuneiform Stylus*, Florence)

2 stars, constellations and planets: naming conventions

Sumerian lexical list: section with star names



mul.giš	apin	star	Plow
mul.giš	mar.gid ₂ .da	star	Wagon
mul.giš	gigir	star	Chariot
mul	lu.lim	star	Stag
mul	udu.idim	star	planet ("Wild Sheep")
mul	uga mušen	star	Raven
mul	sag.DU ₃ .A	star	Triangle
mul	muš	star	Snake
mul	balag	star	Harp
mul	gir ₂ .tab	star	Scorpion
mul.giš	ban	star	Bow
mul	uz ₃	star	Goat

forerunner to Urra – *hubullu*, "interest", from Nippur, Old Babylonian (1800–1600 BCE)

2 stars and planets as manifestations of deities

stars as gods (from: "Plow star", compendium of astral science, ca. 1000 BCE)

<i>star name</i>	<i>equated with</i>
^{star} Plow	Enlil, who goes at the front of the stars of Enlil
^{star} Wagon	Ninlil
^{star} Raven	star of Adad
^{star} Snake	Ningišzida, lord of the Netherworld
^{star} Scorpion	Išhara, goddess of the settlements
^{star} Bow	Elamite Ištar, daughter of Enlil
^{star} Goat	Gula
etc.	

planets as gods

<i>planet</i>	<i>name (Akkadian)</i>	<i>associated major deity</i>	
Moon	Šin	same	moongod
Sun	Šamaš	same	sungod, god of justice
Mercury	Šiḫtu ("Jumpy One")	Nabû	god of writing
Venus	Dilbat	Ištar	goddess of love and war
Mars	Šalbaṭānu	Nergal	god of plagues
Jupiter	White Star	Marduk	king of the gods
Saturn	Kayyamānu ("Steady One")	Šamaš	sungod, god of justice

2 chief deities of the pantheon

Anu sky god Uruk

Marduk (Bēl) king of the gods Babylon



Ea
knowledge
Apsû



Sîn
moon god
Moon



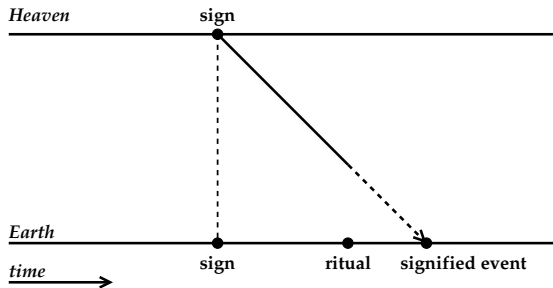
Ištār
love and war
Venus



Šamaš
judgement
Sun

seal impressions from the Akkadian (2300 BCE) and Neo Assyrian (850–600) periods

2 stars, heaven and the gods: divination



celestial omen series “When Anu and Enlil” (ca. 1200 BCE)

[If Jupiter] reaches the head of the Scorpion: in Akkad the existing market rate will be divided by 2. [Tablet 63]

If in month I (Nisannu) on day 1 Šamaš is eclipsed: the king of Akkad will die.

[Tablet 33]

general form: If (*šumma*) P then Q

- P does not cause Q, but both attributable to divine intent

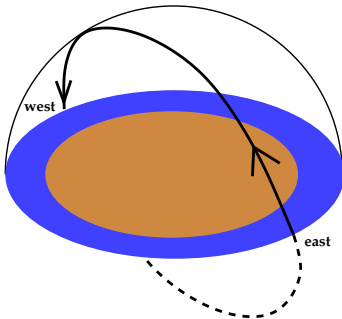
2 heaven and earth: spatial conceptions

heaven

earth

Apsu underworld

tripartite cosmos of mythology and religion



tentative drawing of disk-shaped world



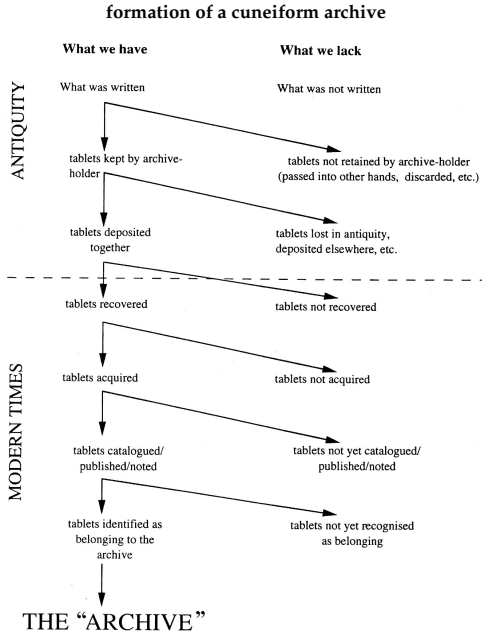
Babylonian "World Map" (British Museum, ca. 850 BCE)

3 sources in context: archives and libraries

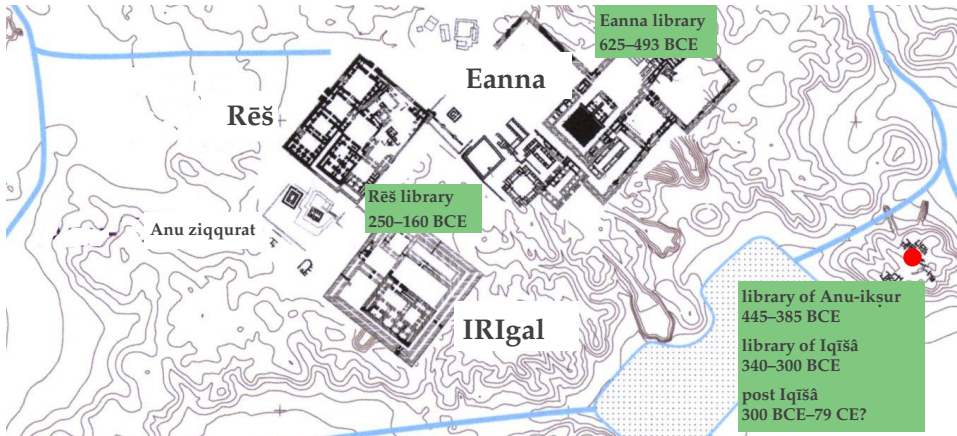
- texts used or produced by scholars belonged to *archives/libraries* and *manuscript populations*
- archives/libraries are loci of *production, interpretation, transformation, and transmission* of knowledge

right: formation of a cuneiform archive/library

(H. Baker, "The Nappāhu Archive", *Archiv für Orientforschung, Beiheft* 30, 2004)

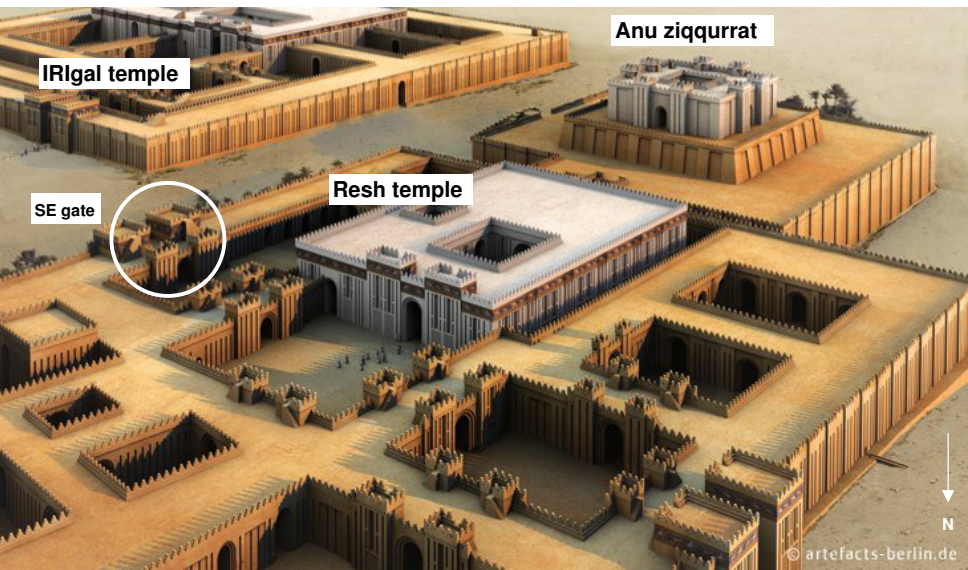


3 sources in context: Uruk



- excavated by German Archaeological Institute (DAI) since 1912
- three known findspots of libraries with astronomical sources (625-160 BCE)

3 sources in context: Uruk, Rēš temple (250–160 BCE)

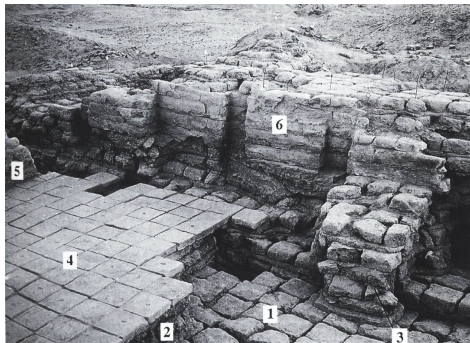
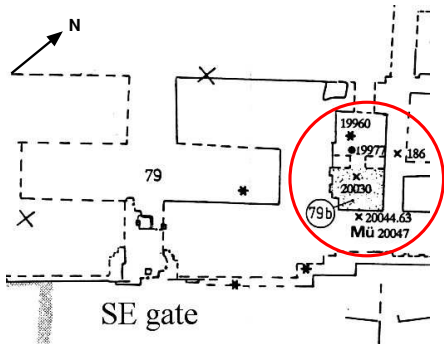


computer-aided reconstruction of Rēš complex (ca. 200 BCE)

3 sources in context: Uruk, Rēš temple (250–160 BCE)

scholarly library in room (79b) off south-eastern gate:

astral science, mathematics, rituals, lamentations, omens, lexical & literary texts, letters, legal acts



from: Kose 1998, *Uruk. Architektur IV*, AUWE 17

- ca. 280 tablets excavated 1912/13, partly in pits near SE gate (Istanbul, Berlin)
- ca. 100 tablets (Paris, Chicago, Yale, Berlin) acquired through market ca. 1912
- ca. 170 tablets excavated 1959/60 in room 79b (Baghdad, Heidelberg)

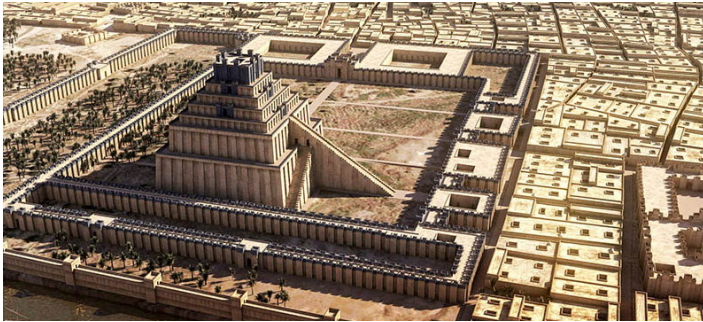
3 sources in context: Babylon



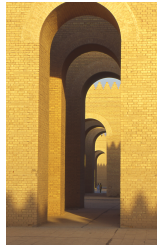
British Museum – Middle East department

- 1 *Babylon collection* (British Museum): ca. 25000 tablets, ca. 650 BCE – 50 AD, acquired 1872–1891 among which ca. 5000 with astral science
- 2 other astron. tablets acquired through market: Berlin, Birmingham, New York, Paris, Philadelphia
- 3 German excavations by Robert Koldewey 1899–1917
ca. 6500 tablets, among which ca. 30 (?) with astral science (Berlin, Istanbul, Baghdad)

3 sources in context: Babylon

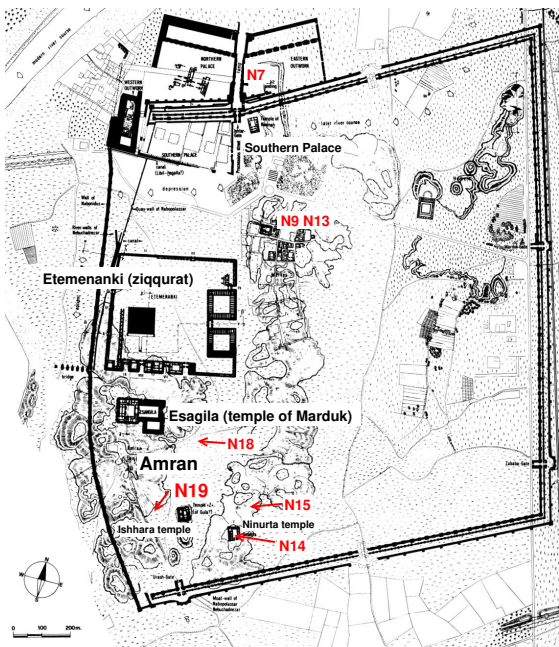


reconstruction of ziqqurat Etemenanki and temple Esagil (Ontario Museum)



reconstructed Istar gate (Vorderasiatisches Museum, Berlin) and Southern Palace

3 sources in context: Babylon



Tell Amran = approximate findspot of astronomical tablets from Babylon collection (British Museum)

tablets with astral science excavated by Koldewey:

- N7: stray find (1 tablet)
- N9, N13: stray find + private houses (3)
- N14: private archive in Ninurta temple (1)
- N15: archives in private houses (4)
- N18: archive in private house (1)
- N19: archive in private house or official building (10)

O. Pedersen 2005, *Archive und Bibliotheken in Babylon*

Ph. Clancier 2009, *Les bibliothèques en Babylonie dans la deuxième moitié du 1^{er} millénaire av. J.-C.*

3 sources in context: Babylon



ina amat Bēl u Bēltija lišlim

At the command of Bēl (Marduk) and Bēltiya may it remain intact



mathematical astronomy: procedure text for the Moon (BM 35399)

3 sources in context: Babylon

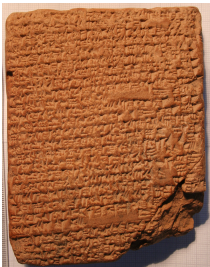


Copied from a wooden board and checked.

Tablet of Marduk-šāpik-zēri, son of Bēl-apla-iddin, descendant of Mušēzib.

Hand of Iddin-bēl, son of Marduk-šāpik-zēri, descendant of Mušēzib.

At the command of Bēl (Marduk), Bēltiya ... may it remain intact.



mathematical astronomy: procedure text for Moon and planets (BM 41004)

4 methodological aspects: approaching Babylonian astronomy

was there “science” in Babylonia?

modern definition of scientific practice (natural sciences):

systematic observations, experiments & measurements that produce knowledge in the form of testable explanations and predictions

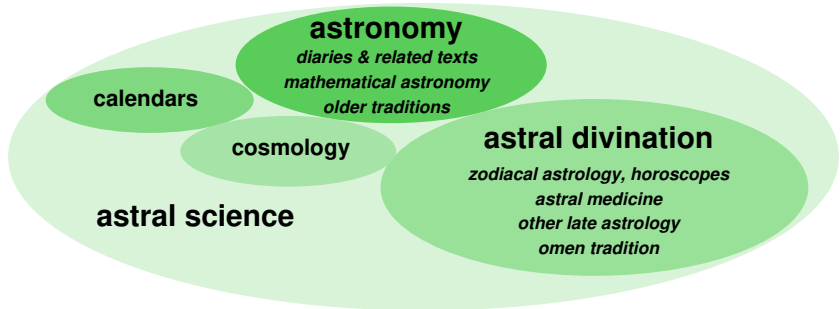
working definition for Babylonian context:

science = scholarship =

systematic investigations of phenomena (observation, classification, interpretation, explanation, prediction)
or of (written) knowledge (classification, interpretation, explanation)

4 methodological aspects: approaching Babylonian astronomy

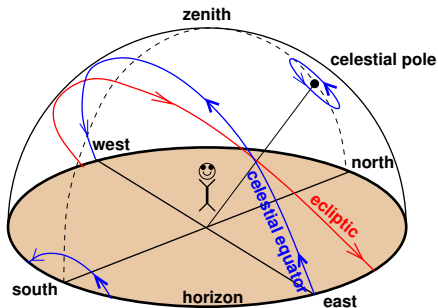
Babylonian astral science 750 BCE – 50 AD



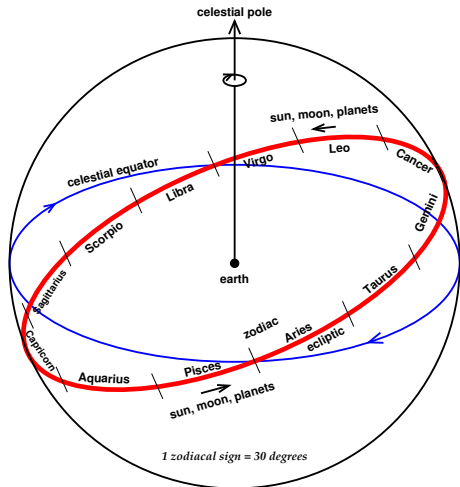
history of ancient science: onion model

level 0	phenomena that were investigated by ancient scholars	<i>natural history</i>
level 1	investigations of phenomena by ancient scholars	<i>its object: level 0</i>
level 2	investigations of ancient science	<i>its object: level 1</i>
level 3	investigations of past research on ancient science	<i>its object: level 2</i>

4 Babylonian astronomy: some basic phenomena



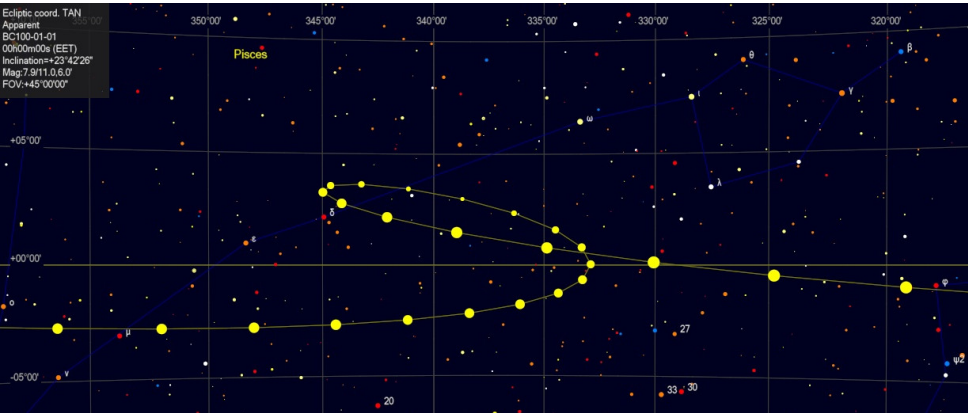
blue: daily rotation of sky, East to West
red: path of sun, moon, planets (ecliptic)



4 methodological aspects – reconstructing ancient practices

history of ancient astronomy – unique opportunities

- astronomical phenomena governed by accurately known laws
- they can often be identified and reconstructed (simulated) for ancient dates



positions of Mercury at intervals of 3 days for observer in Babylon, 100 BCE

software: Skychart – Cartes du Ciel, free download at <https://www.ap-i.net/skychart/>

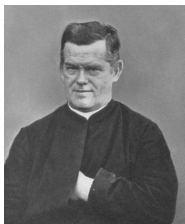
4 brief history of research on Babylonian astronomy

- 1 1881 – 1935 pioneering phase
- 2 1935 – 1990 standard editions of corpora
- 3 1990 – new perspectives on interpreting and contextualizing Babylonian science

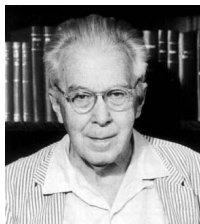


Joseph Epping
1835–1894
mathematician

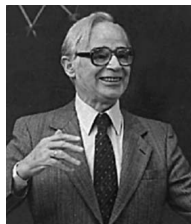
Johann Strassmaier
1846–1920
oriental scholar



Franz Kugler
1862–1929
chemist



Otto Neugebauer
1899–1990
mathematician



Bartel van der Waerden
1902–1996
mathematician

scholarship on Babylonian astronomy: brief time line (phases 1–2)

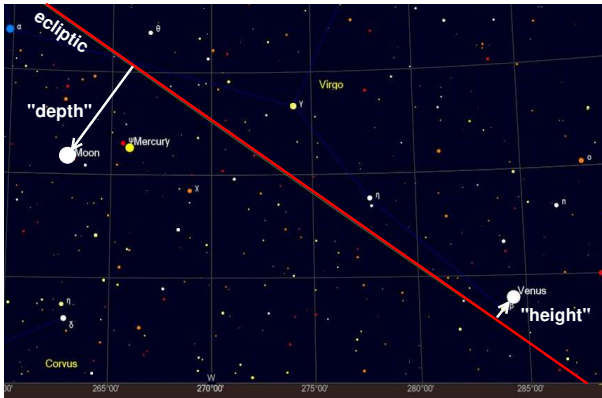
- 1872 Bismarck's *Jesuitengesetz*: German Jesuits expelled to Holland, England, other countries
- 1872–1890 1000s of astronomical tablets from Babylon arrive at British Museum
- 1881 *On the Decipherment of the Astronomical Tablets of the Chaldeans* (Epping, Strassmaier)
- 1900–1924 *Babylonian Lunar Computation; Astronomy and Astral Religion in Babel* (Kugler)
- 1955 *Astronomical Cuneiform Texts* (Neugebauer)
- 1988–2014 *Astronomical Diaries and Related Texts I–VII* (Abraham Sachs, Hermann Hunger)

4 methodological aspects – translation, representation, interpretation

sender \Rightarrow text \Rightarrow translator–interpreter \Rightarrow translation \Rightarrow receiver

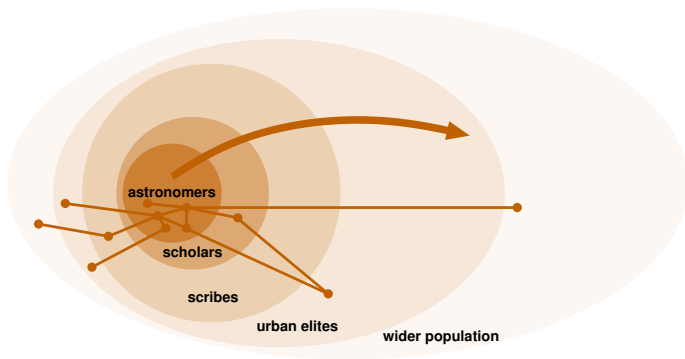
issue 1: diverging Babylonian and modern astronomical conceptions

example: Babylonian “height” and “depth” vs. modern “positive/negative latitude”



issue 2: use of modern formulas and graphs

4 methodological aspects – sociological and social network approaches



example: **Ludwik Fleck** (1896–1961), polish microbiologist, pioneer of sociology of science
Genesis and Development of a Scientific Fact (1935/1979)

- knowledge is produced in *thought collectives* through social interactions
- members of thought collective share a *thought style*
- acceptance of knowledge beyond thought collective requires
 - 1 “translation” to other scholarly collectives and lay circles
 - 2 transfer of measurement instruments and procedures to other scholarly collectives