Photographs of Jupiter, taken Oct.–Dec. 1916 (presented by J. H. Reynolds).

The Star Identifier, and diagram for the graphical solution of problems in nautical Astronomy (Planisphere, with explanation and examples). Constructed and presented by J. E. McGegan.

On Frederick de Houtman's Catalogue of Southern Stars, and the Origin of the Southern Constellations. By E. B. Knobel.

The origin of the constellations surrounding the South Pole is involved in much obscurity. They have all been attributed to various Dutch, Spanish, Portuguese, and Italian navigators, but the original records of the observation and formation of the different constellations appear to be lost.

The earliest existing map of the southern heavens is found in the map of the world made by Peter Plancius in 1594, entitled "Orbis terrarum typus de integro multis in locis emendatus Petro Plancio, 1594," given by Linschoten (*Navigatio ac Itinerarium*, 1599). In this map, besides the Ptolemy constellations, are shown Columba (the stars of which are in Ptolemy), Crux as a separate constellation (also in Ptolemy), Eridanus continued from Ptolemy's 34th star to α Eridani, Triangulum Australe, and a large constellation in the figure of a man called Polophilax, consisting of seven stars which I have not identified. The two Nubeculæ are shown, but nothing else. It is tolerably clear that at this date no other southern constellations were known. Thomas Hood (*Celestial Map*, 1590) states that no more stars than those in Ptolemy have been observed.

The earliest publications containing the constellations surrounding the South Pole as we know them, are in Frederick de Houtman's *Catalogue of Stars*, Bayer's *Uranometria*, and Blaeu's *Celestial Globe*, which all appeared in the same year, 1603.

In the 49th map of Bayer's *Uranometria*, published at Augsburg, 1603 September, are shown the constellations Phœnix, Hydrus, Tucana, Grus, Indus, Pavo, Apus, Triangulum Australe, Musca, Chamæleon, Volans, and Doradus. His map of Eridanus shows the continuation beyond the last of Ptolemy's stars to α Eridani; it also gives some stars in Phœnix and Doradus; that of Canis Major gives Columba, "recentioribus Columba"; Argo shows some stars in Volans; Centaurus includes Crux as a figure, and Triangulum Australe; Ara shows some stars in Triangulum, Grus, and Pavo; Piscis Austrinus includes stars in Grus. Bayer states that these constellations were observed partly by Amerigo Vespucci, partly by Andrea Corsali and Pedro de Medina, but their places were determined by that "most learned" seaman Petrus Theodorus.

Blaeu in his *Celestial Globe*, published in 1603, ascribes all the above constellations to Frederick de Houtman. Merula (*Cosmo-*

graphia Generalis, 1605) attributes all the observations of the "longitudes, latitudes, declinations, etc.," of the stars in question to Petrus Theodorus. Julius Schiller (1627) quotes Bayer, and mentions that these constellations are found on globes by "Petrus Plancius, seu Petrus Karif, Jansonius (Blaeu), and Houtman, etc." Sherburne (1675) says that these constellations were "first found out and denominated by some eminent navigators sayling beyond the line, as particularly by Americus Vespuccius, Andreas Corsalius, Petrus Medina, but principally by Fredericus Houthman, who, during his abode in the island of Sumatra, made exact observations of them, being by Petrus Theodorus and Jacobus Bartschius reduced into order." Weidler gives merely the statements of Bayer and Blaeu. Ideler gives equal merit to Petrus Theodorus and Frederick de Houtman.

I have explored the resources of the British Museum as far as possible, to throw light upon the claims of the above persons.

Of Amerigo Vespucci it is quite clear that he contributed little or nothing to our knowledge of the southern heavens. He states that "the stars of the South Pole are much larger and brighter than those of our pole"; though, in a work published two years before his death (*Sensuyt le nouveau monde et navigations faictes par Emeric de Vespuce*, 1510), he says correctly, "There is no bright star near the South Pole." In his third voyage he says he has "noted as many as twenty stars as bright as we sometimes see Venus and Jupiter." He gives a sketch of a few stars which cannot be identified. He concludes thus: "I have known many other very beautiful stars which I have diligently noted down, and have described very well in a certain little book describing this my navigation, which at present is in the possession of that most serene King (of Portugal), and I hope he will restore it to me." Vespucci mentions no constellation, and gives no reliable observation.*

Coignet (*Instruction nouvelle touchant l'art de naviguer*, Anvers, 1581) says: "Albericus Vespucius escrit de trois etoilles qui ont leur mouvement à l'entour du Pole Antarctique, faisans ensemble un triangle rectangle, dont le milieu est $9\frac{2}{5}$ degrez du Pole Antarctique." These are possibly the stars β Hydri, β Octantis, and ν Octantis.

Of Andrea Corsali (1517) all we know is contained in two letters given by Ramusio (*Navigationi e viaggi*, 1563–74), in which he exclaims on the wonderful sight of the southern heavens, and describes the two Nubeculæ and the Southern Cross of five stars. He gives a sketch showing Crux and the Nubeculæ with thirteen other stars which cannot be identified. He mentions no other constellation, nor is there any further astronomical reference in his letters.†

* Vespucci states that he observed the new moon on the same day that it was in conjunction with the sun!

† There is much confusion in Houzeau (*Annals of Brussels Observatory*, tome 1), who says that the first grouping of the southern stars was made by the seaman Peter Theodore, and *published* in 1516 by Andrea Corsali.

The Spanish navigator Pedro de Medina (born about 1510) is known in this connection from his work *Arte de navegar*, 1545, of which several editions were published in Spanish, Italian, and French. All in the British Museum have been examined, and the only reference to southern stars is his instruction for determining the latitude in the southern hemisphere by observations of α Crucis, which he says has a "declination" of 30°, by which he means south polar distance. This value for his period is in error about half a degree. No other constellation is mentioned, or any other stars than those in Crux. Other Spanish works on navigation by Rodrigo Zamorano (1581), and Garcia de Palacio (1587), and Clavius (*Sacrobosco Commentarius*, 1585), give similar instructions.

Before considering the question of Petrus Theodorus, it will be convenient to enumerate the southern constellations which were known prior to the first Dutch expedition to the Indies:—(1) Crux, first mentioned by Pigafetta in his journal of Magellan's voyage, 1519, in which he also mentions the two Nubeculæ. (2) The continuation of Eridanus beyond Ptolemy's 34th star to α Eridani, first mentioned by Robert Hues in his *Tractatus de globis*, 1592, in which he says: "There are but three stars of the first magnitude that I could perceive in all those (southern) parts which are never seen in England. The first of them is that bright star in the stern of Argo, which they call Canobus; the second is in the end of Eridanus; the third is in the right foot of the Centaur; to which, if you will add a fourth, the which is fixed on the Centaur's left knee, I shall not much stand against it, but other stars of the first magnitude than those which I have named, that part of the world cannot show us.". (3) Columba, a constellation probably made by Plancius out of the unformed stars of Ptolemy's Canis Major. (4) Triangulum Australe, which first appears in Plancius's map of 1594, but the origin of which has not been traced. (5) Polophilax, a large constellation of seven stars given by Plancius (not mentioned by Ideler, *Sternnamen*). This is clearly a group of seven stars which Andrea Corsali shows in the drawing in his letters given by Ramusio. Blundeville (*His Exercises*, 1594), speaking of his celestial globe, says: "Least the South part of this hemisphere or halfe globe should remain void and emptie, I have taken these Southerne Starres of the observation of Andreas Corsalius Florentine, and haue diligently compared the same with the writings of Americus Vesputius and of Petrus Medina, and haue reduced the said starres into this forme or shape. But for so much as I haue seen nothing as yet to my satisfaction or contentment touching the longitude, latitude, magnitude or nature of the said starres." Further on he says: "There are lately found out by the Portugales and others that have sailed in the East and West Indies four other images towards the South Pole, as the Crosse or Croster, the South Triangle, Noah's Dove or Pigeon, and another image made like a philosopher, called Polophilax, all which are set down in the celestial globe lately set forth by M. E. Mullineaux." He adds that the longitude and

latitude of Polophilax "hath not as yet been rightly set down by any that I have read." This shows that Columba, Triangulum Australe, and Polophilax were known before the publication of Plancius's map of 1594. Jodocus Hondius (*Construction and use of the Globes*, 1597, in Dutch) mentions only the remarks of Andrea Corsali.

So far the evidence does not warrant Bayer's attributing any of the southern constellations to Vespucci, Corsali, or Pedro de Medina. He probably made the statement on the authority of the above quotation from Blundeville.

Much uncertainty has existed as to the identity of Petrus Theodorus, and of the extent of his contributions to our knowledge of the southern constellations. His name is given in Latin as Petrus Theodorus F. Embdanus, and in German, Peter Theodors Sohn; but in 1825 Moll, in his work on the early naval expeditions of the Dutch (*Verhandeling over eenige vroegere zeetogten der Nederlanders*), identified him as Pieter Dircksz, or (as the final z stands for zoon) as Pieter Dirckszoon; but he was unable to find any information about him, and he inquires whether this is the same person mentioned by Blaeu as Frederick de Houtman. I find in a Dutch dictionary that the English equivalent of the Dutch name "Dirk" is "Theodoric"; hence, in translating the Dutch name Pieter Dircksz(oon) into Latin, it became Petrus Theodorus F(ilius). From Olbers (*Schumacher Jahrbuch für* 1840) and De Jonge (*De opkomst van het Nederlandsch Gezag in Oost-Indie*, 1862) we learn that his full name was Pieter Dircksz Keyzer. This man was instructed in mathematics and astronomy by Petrus Plancius, who was celebrated as a geographer and for his knowledge of astronomy and nautical matters, and who was one of the principal promoters of the Dutch expeditions to the Indies.

The first expedition of the Dutch to the East Indies sailed from the Texel 1595 April 2. It consisted of four ships, the second of which, the *Hollandia*, commanded by Jan Dignumz, carried Pieter Dircksz Keyzer as chief pilot and head of the steersmen, and Frederick de Houtman as sub-commissioner in the mercantile part of the expedition, with whom we here first become acquainted. From the journals and log of this ship (*Linschoten Vereenigen*, Cornelis Houtman's voyage) and De Jonge (*Opkomst, etc.*) we learn that the *Hollandia* arrived at Madagascar about 1595 September 3,* and stayed there some time. It was here that Pieter Dircksz Keyzer "sought comfort in science, and enriched his knowledge of astronomy by improving the position of old and the observation of new constellations." It must have been at this time that Frederick de Houtman prepared that portion of his vocabulary, referred to below, which deals with the dialect of Madagascar. The ship went on to the Malay Archipelago, and though it is difficult to be certain about dates, it apparently anchored at Achin in Sumatra about 1596 June 5. After three months there it went on to the Straits of Sunda, where on 1596 September 13

* September 25 in Purchas's *Pilgrims*.

Pieter Dircksz Keyzer died. Frederick de Houtman returned in the *Hollandia*, arriving in Holland about 1597 August 10. In the following year, on 1598 March 15, he went out again with a fleet, in command of the ship *De Leeuwin*. The chief pilot of the fleet was John Davis (not to be confounded with John Davis of Dartmouth, the inventor of the Davis Quadrant), and from Davis's journal we learn that the fleet arrived at Achin in Sumatra 1599 June 21. Tiele (*Mémoires sur les voyages Néerlandais*) says that Frederick de Houtman was taken prisoner by the King of Achin in 1598, and kept so for twenty-six months. This can hardly be correct, as he did not arrive there till sometime in 1599. He was, however, for a long time prisoner, and only escaped on 1600 December 31, when he went on board a ship commanded by van Caerden, which was then at Achin. He then returned to Holland. To conclude his career, in 1603 he went out on another voyage as mercantile commissioner, and two years after became governor of Amboyna. I have thus endeavoured to account for all Frederick de Houtman's time, which bears upon the authenticity of his *Catalogue of Stars*.

In 1603 * Frederick de Houtman published at Amsterdam a Malay and Madagascan vocabulary, entitled *Spraeckende woordboeck Inde Maleysche ende Madagaskarche Talen met vele Arabische ende Turksche woorden*. At the end of this work he gives a catalogue of southern stars, the title-page of which is thus translated: "Here follow several fixed stars (observed), with efficient instruments, by Frederick de Houtman, in the island of Sumatra, (their positions) corrected and their numbers increased. For the use and service of those who navigate south of the equinoctial line, also for all amateurs and those who have occasion for the best. These stars are arranged according to their Right Ascension; that is, the degree and minute which a star in the south or north has from where the equinoctial line cuts through (*sic*). Declination is the number of degrees and minutes a star is distant from the equinoctial line towards the South or North Pole. Magnitude is the size of the stars: often a star is of the first size or greatest light: thus there are seven (*sic*) degrees of size and light." In a dedicatory letter to the vocabulary Houtman says: "There will be found at the end the declinations of several fixed stars in the region of the South Pole which I had observed on my first voyage, and which on my second voyage I revised and corrected with more care and brought up to the number of 300, as may be seen on the *Celestial Globe* published by William Jansen (Blaeu)."

This work is extremely rare; every effort that I have made for many years to obtain a copy in Germany, France, Italy, and elsewhere, and by advertising, has failed. Four copies are certainly known, at the British Museum, the Bodleian, the Bibliothèque Nationale, and at Leiden. Thanks, however, to the enterprise of

* Gould is in error in stating that Bayer's *Uranometria* antedated Houtman's *Catalogue*. They were both published in the same year.

Professor Turner, he has had the copy in the Bodleian photographed, and thus this interesting catalogue—the first catalogue of southern stars ever made—is available.*

The catalogue consists of the right ascensions, declinations, and magnitudes of 303 stars, of which 107 stars are found in Ptolemy, leaving 196 newly discovered. The right ascensions are too rough to allow of identification, but by plotting the whole catalogue in a map, and comparing with the maps of the *Uranometria Argentina*, it has been easy to identify nearly every star. The object of the catalogue was to determine declinations for the use of seamen; accordingly, a comparison of the declinations of some fifty stars, with modern observations reduced, is appended.

The new stars are thus distributed:—

Phœnix	13	Volans	5
Corona Australis	7	Chamæleon	9
Eridanus	6	Lupus	14
Hydrus	15	Triangulum Australe	4
Dorado	4	Apus	9
Columba	1	Ara	5
Argo Navis	34	Pavo	19
Centaurus	18	Indus	11
Crux	1	Grus	11
Musca	4	Tucana	6
			196

Was this catalogue made by Frederick de Houtman at Sumatra on the occasions of his two voyages there, as he states?

On his first voyage, then twenty-four years of age, he was in a purely commercial capacity, and there is no record of his being an astronomer or of his having any mathematical ability. Most of his time at Sumatra on both occasions was at Achin, which is in latitude 5° 34′ North; and, as we infer from the ship's journals of the first voyage, he was there on that occasion only some three or four months. The journal of his second voyage is not published, but we have enough information to infer that while at Achin he had but a limited time at his disposal, as he was early taken prisoner by the king and kept in confinement for many months; and unless we assume that during his imprisonment he was able to make astronomical observations, there would have been no sufficient time for an inexperienced man to make the catalogue in question.† How did he determine the right ascensions, rough as they are? In his catalogue he gives the positions of twenty-four

* I had commenced the investigation of this catalogue in 1882, and only after translating some portions of it did I become aware that a translation of the work into French by M. A. Marre had appeared in the *Bulletin des Sciences Mathématiques*, tome v., 1881. I acknowledge several quotations from M. Marre's memoir.

† The dates given by De Jonge (*Opkomst*) for the second voyage do not agree with those in the "Account of Frederick de Houtman at Achin" (*Cort verhael, etc., Gouda*, 1880).

stars, 7 of the 4th, 15 of the 5th, and 2 of the 6th magnitude, whose zenith distances at Achin ranged from 80° to 89° 15′; *obviously he could not have seen them at all.*

It is practically certain that the catalogue used by Bayer was identical with most of Houtman's catalogue, but it contained some additional stars. Blaeu's *Globe*, of which there are two somewhat mutilated examples in the British Museum, is certainly limited to the stars published by Houtman in his vocabulary. According to different authors, the total number of stars in the twelve constellations, Phœnix, Hydrus, Doradus, Volans, Chamæleon, Musca, Apus, Triangulum Australe, Pavo, Indus, Grus, and Tucana are—

Houtman, 1603	112
Bayer, 1603	121
Bartsch, 1624, Text	121
,, ,, Catalogue	131

Kepler, *Tab. Rudolph*, 1627, as Bartsch's catalogue.

Houtman, who was at the time very ill, escaped from prison on 1600 December 31, and he could hardly have got back to Holland before the end of 1601. The preparation of Bayer's *Uranometria* would take considerable time, and it is highly probable that he possessed the materials for his maps some time before Houtman's return. Whence did he obtain those materials?

Pieter Dircksz Keyzer, who was versed in mathematics and astronomy, and was held in high estimation by the Dutch East India Company, would have a favourable opportunity during the long stay of the *Hollandia* at Madagascar, from 1595 September to April or May of 1596, to make observations and to chart the new constellations. As Merula says: "sedens ibi in corbe, vel ut vocant nonnulli, galea." In that latitude he could quite well observe 5th and 6th magnitude stars near the South Pole. For the right ascensions we may surmise that Plancius would furnish him with some of Tycho Brahe's observations, from which they might be roughly derived; certainly there was no other material available for the purpose. I have failed to find any information as to relations between Tycho Brahe and Plancius.

Frederick de Houtman was in Pieter Dircksz's company all the time, but as commissioner he would be engaged in the development of trade, and, moreover, he was then collecting materials for his Malay and Madagascan vocabulary. Though all the evidence is circumstantial, the following inferences are irresistible: that the whole catalogue and the formation of the new twelve constellations must be attributed to Pieter Dircksz Keyzer, and not in any way to Frederick de Houtman: that the catalogue was sent back by the *Hollandia*, and after the return of that ship on 1597 August 10 it would go to Plancius, who probably communicated it to Bayer: and that Frederick de Houtman obtained an imperfect copy of it which, as Pieter Dircksz was dead, he published as his own work in the above-mentioned vocabulary.

Since coming to this conclusion I learn, a few weeks ago, from a high authority in Holland, that the opinion there at the present time is to the same effect, and that the Linschoten Society contemplate publishing a full account of Pieter Dircksz Keyzer.

In either case the whole merit of the discovery and formation of the constellations must be attributed to the Dutch.

The catalogue gives the descriptions of the stars, which I have translated from the Dutch, and compared with the translation of M. Marre. The modern designations are from the *Uranometria Argentina*, and the magnitudes from that work are appended.

In the table which follows, the declinations of fifty stars are compared with Neugebauer's *Sterntafeln*. No information can be found as to the instruments used, which were probably limited to the astrolabe and quadrant. With such instruments the comparison shows that some of the observations were very good.

Catalogue of Stars given in Frederick de Houtman's Malay and Madagascan Vocabulary.

No. and Description.	No. and Name. *Uranometria Argentina.*	Magnitude. H.	Magnitude. U.A.	R.A.	Decl.
The bird Phœnix has 13 stars.					
Phœnix.					
1. The most northern star in the flame	16 Sculptoris β*	5	4·8	347° 20′	40° 50′
2. The middle one in the flame	11 Phœnicis	5	4·5	348 35	44 15
3. The most southern star in the flame	9 ,, ι	4	4·4 *v*	349 45	42 45
4. One in the right wing	39 ,, ϵ	4	3·8	357 10	47 45
5. A star in the neck of the bird Phœnix	48 ,, α	2	2·4	1 0	44 5
6. One in the neck	46 ,, κ	4	3·9	1 30	45 34
7. One in the body of Phœnix	54 ,, λ^1	4	4·6	2 40	50 15
8. One in the breast	64 ,, μ	4	4·7	4 30	47 30
9. One below the right foot, in the wood	68 ,, η	4	4·5	7 20	59 30
10. One below the left wing, in the flame	85 ,, β	3	3·3	11 20	49 20
11. One below the left foot, in the wood	89 ,, ζ	4	4·2	13	57 0
12. At the end of the left wing	106 ,, γ	3	3·4	18	44 45
13. One below the same wing, in the fire	109 ,, δ	3	4·0	19 30	51 25
The Southern Crown has 16 stars.					
Corona Australis.					
1. The most western star in the crown	15 θ	4	5·1	269 18	41 45
2. The second following it	13	5	5·6	270	40 15
3. The third ,,	16 κ	5	5·4	270 10	39 18
4. The fourth ,,	18	5	5·8	271 26	43 16
5. The fifth ,,	25 η^1	5	5·7	273 28	44 10
6. The sixth ,,	32	5	6·6	275 36	45 20
7. The seventh ,,	30	6	5·8	276 30	43 30

* The positions of 1, 2, and 3 Phœnicis are erroneous; Bayer gives correctly the identified stars.

Catalogue of Stars given in Frederick de Houtman's Malay and Madagascar Vocabulary—continued.

No. and Description.	No. and Name. *Uranometria Argentina.*	Magnitude. H.	Magnitude. U.A.	R.A.	Decl.
				° ′	° ′
8. The eighth following it	39 ζ	5	5·2	277 35	43
9. The ninth ,,	43 δ	4	5·0	278 40	42 2
10. The tenth ,,	46 β	4	4·1	279 45	40 35
11. The eleventh ,,	44 α	4	4·2	280 30	38 50
12. The twelfth ,,	41 γ	5	4·6	280	37 30
13. The thirteenth ,,	34 ϵ	5	5·5	277 37	37 40
14. The fourteenth ,,	19 λ	5	5·4	274	38 20
15. The fifteenth ,,	20	5	5·6	274 25	40
16. The last star in the crown	24 μ	5	5·5	274 50	41
The southern end of the Nile, with corrections and additions. 7 stars.					
Eridanus.					
1. Acarnar, the end of the Nile	2 α	1	1·0	20 50	59 20
2. The first star following	7 χ	4	3·9	25 20	54 30
3. The second ,,	14 φ	4	3·5	31 25	53 45
4. The third ,,	16 κ	4	4·2	33 50	49 30
5. The fourth ,,	18 S	4	5·0	35 40	44 24
6. The fifth ,,	19 ι	4	4·2	37 24	41 28
7. The sixth following in the Nile	48 θ	3	2·6	41 20	41 50
The Water-snake has 15 stars.					
Hydrus.					
1. The head of the water-snake	24 α	2	2·9	26	63 30
2. One star in the neck	32 Horologii β	5	5·2	38 23	65 0
3. The second following	47 Hydri ζ	5	5·2	41 38	68 25
4. The third ,,	44 ,, ϵ	5	4·2	39 50	69 18
5. The fourth ,,	38 ,, δ	5	4·1	34 45	70
6. The fifth is above the small nebula (Nubecula minor)	70 Tucanæ λ^2	5	5·5	16 50	71 45
7. The sixth following	50 ,, π	5	5·7	10 27	72 15
8. The seventh ,,	47 ,,	5	6·8	4 30	75 10
9. A star above the preceding one.	45 ,,	5	5·9	356 42	74 6
The small nebula	Nubecula minor	...	...	14 25	75
10. The ninth following	5 Hydri β	4	2·7	4 30	80 12
11. The tenth ,,	88 Octantis θ	6	5·4	359	79 30
12. The eleventh situated in the tail	75 ,, β	4	4·4	332 45	83 40
13. The end of the tail	60 ,, ν	4	3·8	312 34	78 46
14. One before the breast of the water-snake	14 Reticuli β	4	3·9	56	65 45
15. One situated below the last	62 Hydri γ	4	3·2	62 30	74

Catalogue of Stars given in Frederick de Houtman's Malay and Madagascar Vocabulary—continued.

No. and Description.	No. and Name. *Uranometria Argentina.*	Magnitude. H.	Magnitude. U.A.	R.A.	Decl.
Doradus has 4 stars.					
1. The extremity of the tail	8 α	3	3·1	62° ′	53° 20′
2. One below the fin, near the tail	20 ζ	3	4·8	67 50	56 26
3. One above the body	29 β	3	3·9	85 20	61 54
4. One below, near the mouth	33 δ	3	4·5	87 33	65 12
The Dove with the Olive Branch. Columba.					
1. The right (? left) wing	22 ε	5	4·1	79 40	36 18
2. The bright star in the body	38 α	2	2·5	82 0	34 25
3. One under the left wing	41	5	6·4	82 40	31 54
4. The right shoulder	53 β	2	2·9	84 0	36 10
5. The right wing	57 λ	5	5·2	84 45	34 15
6. One in the neck	65 γ	5	4·5	86 15	36 0
7. One in the beak	79 θ	5	5·3	90 40	37 50
8. The southern end of the olive branch	66 η	5	5·8 *v*	86 5	42 30
9. One above the head, in the olive branch	84 κ	5	4·8	91 40	35 0
10. The second one above this	91 δ	5	3·9	92 50	33 20
11. The most northern of these	35 Canis Maj. λ	5	4·7	93 42	32 15
Argo Navis. The Ship.					
1. The sounding line	32 Pictoris β	5	3·9	84 32	51 42
2. One in the water, behind the rudder	35 ,, γ	3	4·7	87 20	56 10
3. One below the rudder	48 ,, δ	4	5·2	91 10	54 12
4. Canopus, the brilliant star in the rudder of the ship	7 Carinæ α	−1	0·4	93 40	52 15
5. One in the hand of the steersman	20 Puppis ν	4	3·5	95 45	42 14
6. One behind this, in the stern gallery	39 ,, τ	4	3·2	99 25	49 55
7. One in the stern of the ship	18 Carinæ A	3	4·8	99 30	52 35
8. One behind this, below the ship	66 Pictoris α	4	3·5	100 15	61
9. One in the mizen-mast	99 Puppis σ	5	3·5	110 12	42 20
10. One above this, in the mizen-shrouds	162 ,,	6	5·7	111 40	37 0
11. One in the mizen-yard	213 ,, *a*	4	4·0	113 45	34 30
12. One above, in the mizen-top	214 ,, *b*	5	4·9	115 30	30 25
13. One at the end of the main drift,* against the main shrouds	65 Carinæ κ	3	3·7	115 40	52 20

* 13. Argo. The Dutch word here is "fortuning," which in modern Dutch is "vertuining," and means the old shipbuilders' term "drift," where the sheer is raised and the rail cut off: here it is the main-drift. Argo in the catalogue is a three-masted ship.

Catalogue of Stars given in Frederick de Houtman's Malay and Madagascar Vocabulary—continued.

No. and Description.	No. and Name. *Uranometria Argentina.*	Magnitude. H.	Magnitude. U.A.	R.A.	Decl.
14. One at the ridge of the main yard	248 Puppis ζ	3	2·5	116° 30′	*32° 0′
15. One in the bolt-rope of the main-sail	267 ,, h^1	5	4·8	117 10	38 15
16. One other near this	279 ,, h^2	5	4·8	117 20	39 40
17. One in the main-rigging	9 Velorum γ	3	3	119 30	46 25
18. One in the fore-shroud	56 ,, o	4	4·0	124 50	51 40
19. One in the main-mast	48 ,, e	5	4·6	125 40	42 12
20. A small star below this	58 ,, n	6	5·2	125 45	47 0
21. Another small star near this	53 ,, b	5	4·1	126 35	45 30
22. One in the main-sail	66 ,, a	5	4·1	129 0	45 0
23. One above this	64 ,, d	5	4·4	129 30	41 26
24. Another one before this	97 ,, c	4	4·6	132 12	45
25. One above in the sail	100 ,, λ	3	2·5	135 18	42 2
26. One in the main-top	22 Pyxis β	5	4·4	128 20	34 5
27. One at the top of the main-mast	24 ,, α	5	3·8	129 15	31 34
28. One in the main-top mast	36 ,, γ	5	4·4	131 0	26
29. One in the ship, before the main-mast	89 Carinæ ϵ	3	2·1	123 10	58 20
30. One below the main-sail, before the mast	65 Velorum δ	3	2·2	127	53 45
31. One in the rail below the main-sail	127 Carinæ ι	3	2·5	136 20	57 30
32. Another one near the preceding	117 ,, α	4	3·8	134 36	57 28
33. One in the bolt-rope of the sail	129 Velorum κ	3	2·7	137	53 45
34. One below the belly of the sail	144 ,, N	5	3·2	139 25	55 31
35. One below this, in the forecastle	147 Carinæ h	5	4·9	139 50	57 46
36. Another below this, near the shrouds	150 ,, m	5	5·1	140 30	59 10
37. Another below the shrouds	157 ,, l	5	3½–5 v	142	60 35
38. One below the ship	123 ,, β	3	2·0	138	67 30
39. One on the bend-wale, below the anchor	160 ,, υ	3	3·3	143 45	63
40. One in front, below the keel of the ship	185 ,, ω	3	3·6	150 46	68 2
41. One below this	193 ,, I	4	4·4	153 30	71 50
42. One in the stern of the ship	223 ,, θ	3	2·9	155 40	62 20
43. One in the anchor	187 ,, q	5	3·3–4·5 v	149 30	59 30
44. One above the anchor-stock	196 ,, s	4	4·6	151 53	56 50
45. Another in the anchor-stock	203 ,, p	4	3·6	152 54	59 46
46. One above the foresail	204 Velorum r	6	5·3	151	41 23
47. One above, in the foremast	191 ,, q	4	4·0	149 50	41 26
48. One below this, in the shrouds	?	5	...	148 35	42 34
49. Another one below this	193 Velorum	6	6·2	149	44

* 14. Argo. The declination is probably a misprint for 38° 0′.

Catalogue of Stars given in Frederick de Houtman's Malay and Madagascar Vocabulary—continued.

No. and Description.	No. and Name. *Uranometria Argentina.*	Magnitude. H.	Magnitude. U.A.	R.A.	Decl.
50. One in the middle of the foresail	216 Velorum *s*	5	5·4	153° 10′	45° 20′
51. One other near this	218 ,,	6	6·4	152 12	45 36
52. One more near this	219 ,, *t*	5	5·6	155 36	45 50
53. One in the fore-sheet	222 ,, *p*	4	4·1	157 30	46 16
54. One below this	229 ,, *μ*	4	2·9	158 40	48
55. One below, in the foresail	215 ,, *x*	5	5·6	155 46	52 30
56. One below the bowsprit	246 Carinæ *u*	5	4·1	159 30	56 50
Centaurus.					
1. One below, in the tail of Centaurus	260 Carinæ *x*	5	4·6	163 15	57 10
2. The bright star in the tail	24 Centauri *π*	4	4·3	166 55	52 26
3. One other next to this	42 ,, A	5	5·2	170 0	52 15
4. One near the hind-foot of Centaurus	46 ,, *λ*	4	3·4	170 25	61
5. One below, near the foot	15 Muscæ *λ*	4	3·8	172 30	64
6. Another one near this	16 ,, *μ*	6	5·3	173 0	64 30
7. Another one following	69 Centauri *j*	5	4·9	172 35	61 45
8. Another one following	18 Muscæ	5	5·5	174	63
9. Another one in the hind-foot	6 Crucis *θ*	5	4·7	176 40	61
10. One below this	10 ,, *η*	5	4·7	177 35	62
11. One in the foot of the Cross	19 ,, *ζ*	5	4·6	179 34	61 35
12. One above, in the leg of Centaurus	94 Centauri *δ*	3	2·8	178 15	48 18
13. One below this	101 ,, *ρ*	5	4·5	179	50
14. One in the belly of Centaurus	121 ,, *σ*	5	4·3	182 24	47 36
15. A small star near this	119 ,, G	6	5·7	182	48 30
16. One in the body of Centaurus	134 ,, *γ*	3	2·4	186 12	46 48
17. One above this, in the body	131 ,, *τ*	5	4·4	185	46 25
18. Another one in the body	149 ,, *e*	5	5·0	188 50	46 15
19. Another one below, in the body	142 ,,	5	6·2	190	49 10
20. One above the preceding	156 ,, H	5	5·8	190 30	48
21. Another one there above	165 ,, ξ^1	5	5·8	190 45	46 12
22. The uppermost in the body	171 ,, *f*	5	5·3	191 10	45
23. One below this in the body	173 ,, ξ^2	5	4·8	192 43	46 20
24. The left shoulder	204 ,, *ι*	3	3·0	194 40	34 0
25. One below this	227 ,, *d*	4	4·5	196 55	37 20
26. One in the head of Centaurus	265 ,, *i*	5	4·5	200 30	30 40
27. The most northern star in the head	284 ,, *h*	5	5·2	202	29 35
28. One other below this	280 ,, *k*	5	4·7	201 28	30 32
29. Also another below this	274 ,, *g*	5	4·6	201 20	32 10

Catalogue of Stars given in Frederick de Houtman's Malay and Madagascar Vocabulary—continued.

No. and Description.	No. and Name. *Uranometria Argentina.*	Magnitude. H.	Magnitude. U.A.	R.A.	Decl.
30. One above in the right leg	245 Centauri ϵ	3	2·6	199° 50′	51° 15′
31. One on the back of this (constellation)	273 ,, μ	4	3·4	200 20	41 8
32. One above this, on the back	272 ,, ν	4	3·7	200 35	39 58
33. Another one near this	296 ,, ϕ	4	4·1	203 8	40 30
34. Another one following	311 ,, χ	4	4·8	205 16	39 40
35. One in the belly	289 ,, ζ	3	2·7	202 18	45 20
36. One above in the right side	297 ,, v^1	4	4·2	203 15	43
37. Another one near this	303 ,, v^2	5	5·0	204 10	44
38. One in the left leg of Centaurus	304 ,, β	2	1·2	204 20	58 8
39. One in the right foot of Centaurus	363 ,, α	1	0·7	213 48	58 48
40. One below this, near the foot	17 Circini α	3	3·5	210 50	62 30
41. The right shoulder	314 Centauri θ	3	2·2	206 15	35
42. One in the flag (of the lance)	338 ,, ψ	4	4·4	208 40	36 0
43. One below this, in the lance	342 ,, a	4	4·9	209 10	37 35
44. One above, in the flag	371 ,, c^1	4	4·3	214 30	33 20
45. Another one below this	368 ,, b	4	4·2	215 35	35 30
46. One in the right arm	356 ,, η	4	2·5	213 50	41 20
47. One in front, in the same arm	41 Lupi β	4	2·8	217 40	41 18
48. One below this, in the arm	385 Centauri κ	4	3·3	217 45	40 38
Crux.					
1. The western arm of the Cross	18 δ	3	3·4	179 35	56 26
2. One below this	22 ϵ	5	4·0	180 20	58 25
3. The lowest star, or foot of the Cross	26 α	2	1·3	182 25	60 40
4. The head of the Cross	34 γ	3	2·0	183	54 48
5. The eastern arm of the Cross	46 β	3	1·7	186	57 8
Musca.					
1. One below, in the body	44 γ	4	4·0	182 55	69 50
2. One above, in the left wing	45 α	4	2·9	184 10	66 30
3. The head	51 β	4	3·4	186 8	65 20
4. The right wing	54 δ	4	3·7	189 25	69 10
The Flying Fish. *Volans.*					
1. One in the tail of the Flying Fish	10 δ	4	4·1	111 16	67 30
2. Another one below this	9 γ^2	4	3·8	111 18	68 32
3. The right wing	16 ζ	4	4·3	119	71 15
4. The left wing	22 ϵ	4	4·5	122 46	67 33
5. One in the neck	25 κ^1	4	4·7	127 10	70

Catalogue of Stars given in Frederick de Houtman's Malay and Madagascar Vocabulary—continued.

No. and Description.	No. and Name. *Uranometria Argentina.*	Magnitude. H.	Magnitude. U.A.	R.A.	Decl.
Chamæleon.					
1. The end of the tail	5 θ	5	4·7	130° 30′	74° 30′
2. One above this, the second in the tail	4 α	5	4·2	128 26	73 40
3. The third in the tail	8 η	5	5·6	140	76 20
4. The fourth in the tail	13 ι	5	5·8	148	77
5. The fifth in the tail	14 ζ	5	5·5	150 34	77 15
6. The most northern star in the back	23 γ	5	4·4	158	75 30
7. One below this, in the body	26 δ^2	5	4·9	161 30	77 25
8. Before the shoulder	37 ϵ	5	5·0	176	74 50
9. One below this, before the body	40 β	5	4·6	179 40	76 20
Lupus.					
1. One in the tail	332 Centauri	5	6·7	208 30	44 25
2. One other above this	2 Lupi	5	6·3	208 35	43 26
3. Another near this	3 ,,	5	5·7	209 40	44 10
4. One at the end of the tail	9 ,, τ^1	6	5·3	210 34	43
5. Another near this	10 ,, τ^2	6	4·9	211	43 15
6. One in the right foot	27 ,, α	4	2·6	213 35	46
7. One other below this	20 ,, ρ	5	4·5	212 45	47 30
8. Another below the preceding	15 ,, σ	5	5·2	*211 15	48 32
9. One in the left buttock	30 ,, δ	5	5·8	215 30	50 52
10. One other near this	42 ,,	5	6·7	218 33	50 45
11. One above, in the left thigh	64 ,, ζ	4	3·6	221 45	50 12
12. One behind, on the hip	44 Circini β	5	4·7	221 42	56 45
13. Another one near this	47 ,, γ	5	5·2	223 32	57 15
14. One below this	42 ,, δ	5	5·6	221 28	59 10
15. Another one, a small star, near this	45 ,,	6	5·9	222	58 30
16. One in the belly	47 Lupi π	4	4·3	219 25	45
17. One below this, in the belly	62 ,, κ	4	4·1	221	46 50
18. One above this, in the belly	57 ,, λ	4	4·8	221 30	44
19. Another one in the belly	75 ,, μ	4	5	222 55	46 30
20. Another one near this	86 ,, υ^1	6	5·8	223 5	47
21. One at the front of the left hip	83 ,, δ	4	3·7	223 30	39 55
22. The heart of the wolf	91 ,, ϵ	4	3·7	224 20	43 40
23. Another one in the body	114 ,, d	5	5·1	227	43 45
24. One at the front of the shoulder	113 ,, γ	4	3·2	227 30	40 16
25. One below this	117 ,, ω	5	4·7	227 56	41 25

* 8. Lupi, right ascension given erroneously by Marre as 211° 11′.

Catalogue of Stars given in Frederick de Houtman's Malay and Madagascar Vocabulary—continued.

No. and Description.	No. and Name. *Uranometria Argentina.*	Magnitude. H.	Magnitude. U.A.	R.A.	Decl.
26. Another one below this	121 Lupi g	5	5·2	228° 15′	43° 3(
27. Another one near this	115 ,,	5	6·2	227 25	43 2!
28. One in the neck	146 ,, η	4	3·7	233 12	37 2(
29. Another one near there	157 ,, θ	6	4·9	235	35 3(
Triangulum Australe.					
1. The southern angle	5 γ	3	3·1	219 20	66 4!
2. One above this	11 ϵ	5	4·6	222 50	64 32
3. The northern angle	17 β	3	3·1	226 18	62 1(
4. The apex of the triangle	42 α	2	2·2	238 45	68
The Bird of Paradise.					
Apus.					
1. One in the foot, by the tail	19 Octantis δ	4	4·7	206 50	80 35
2. One in the tail	6 Apodis η	4	5·3	207 10	77 40
3. Another one near this	9 ,, ϵ	6	5·5	209 8	76 45
4. Another one above this	14 ,, α	4	4·0	212 45	76 26
5. One at the end of the body	40 ,, δ^1	5	5·2	228 40	76 10
6. One below this	44 ,, γ	5	3·9	229 30	77
7. Another one near this	47 ,, β	5	4·5	234	76 20
8. One in the neck	33 Octantis ϕ	5	5·8	261 30	75 25
9. One in the beak	41 Pavonis	5	6·2	271	72 12
Ara.					
1. The west foot of the altar	13 η	4	3·8	241 10	57 30
2. The western part of the upper edge	23 ζ	4	3·2	244	54 40
3. The western part of the flame	25 ϵ^1	4	4·2	245 46	52
4. The eastern part below, in the altar	60 δ	4	3·7	248 32	60 30
5. The eastern part above, in the altar	50 γ	4	3·6	249 42	56 32
6. The eastern part below, in the flame	51 β	4	2·8	250	55
7. One there following, in the flame	62 α	4	2·9	255	49 38
8. The fourth star in the flame	84 θ	4	3·9	262 30	49 35
9. The fifth star in the flame	3 Telescopii ϵ	4	5·2	265 8	46 10
10. The sixth star in the flame	14 ,, ζ	4	4·5	269 20	49
11. The seventh star in this flame	13 ,, α	4	3·5	269 25	46 20
12. The last in this (constellation)	16 ,, δ^1	6	5·7	270 15	46 30
The Tail of Scorpius.					
1. The first, in the tail	98 μ^1	3	3·2	246 30	37 10
2. The second, in the tail	103 ζ	3	5·8	247	41

Catalogue of Stars given in Frederick de Houtman's Malay and Madagascar Vocabulary—continued.

No. and Description.	No. and Name. *Uranometria Argentina.*	Magnitude. H.	Magnitude. U.A.	R.A.	Decl.
3. The third, in the same	104 ζ^2	3	3·6	247° 10′	41° 36′
4. The fourth in this	126 η	3	3·6	252 18	42 32
5. The fifth in this	160 θ	3	2·1	257 30	42 38
6. The sixth, in the tail	169 ι^1	3	3·3	260	39 50
7. The seventh in this	165 κ	3	2·6	258 35	38 45
8. The eighth of this	156 λ	3	2·0	256 34	37
9. The last of the tail of Scorpius					
Pavo.					
1. A star at the extremity of the tail	2 η	4	3·8	252 50	64 40
2. One following, in the same	16 π	5	4·6	259 48	64 10
3. The uppermost, in the same	26 ξ	5	4·4	265 5	62 30
4. One below this	32 ν	6	6·0	266 20	63 50
5. One below this	39	5	5·3	267 22	65
6. One other in the same tail.	45 λ	5	4·3	271 45	63 28
7. One below this	46 κ	5	4·0–5·6*v*	270 30	66 5
8. One other below the preceding	43 θ	6	6·1	270 32	67
9. One at the extremity of the body	56	5	5·7	274 30	69
10. One in the right foot of Pavo	78 ϵ	4	4·0	280 50	73 45
11. One above, in the body	88 δ	3	3·5	290 30	67 30
12. One below this	83 μ^2	5	5·6	289 20	68 15
13. The head	99 α	2	2·1	297 15	58 14
14. One in the neck	104 ϕ^1	5	4·9	299 30	62 30
15. One below this	107 ρ	5	4·9	300 40	64
16. Another one in the neck	109 ϕ^2	5	5·5	301 50	62 33
17. The heart	6 Tucanæ δ	3	4·8	330 36	68
18. One below this	110 υ	5	5·6	*309 45	68 40
19. The breast of Pavo	111 β	3	3·3	311 52	68 30
Indus					
1. The fore-end of his spear	78 Telescopii ξ	5	5·5	291 15	55 16
2. One in the right shoulder	2 Indi η	5	4·7	304 20	54 20
3. One near this, in the shoulder	5 ,, ι	5	5·6	305 30	54 16
4. Another one near this	8 ,,	5	6·0	306 28	54 15
5. One below the belly	6 ,, β	4	3·7	305 30	60 20
6. One in the chest	12 ,, μ	5	5·8	306 40	56 45
7. One in the head	?	4		310 28	52 35

* 18 Pavonis. Misprint of 209° for 309° in the Right Ascension.

Catalogue of Stars given in Frederick de Houtman's Malay and Madagascar Vocabulary—continued.

No. and Description.	No. and Name. *Uranometria Argentina.*	Magnitude. H.	Magnitude. U.A.	R.A.	Decl.
8. The left shoulder	?	4		313° 40′	54° 26′
9. One in the upper part of the spear	?	4		319 45	55 22
10. One in the middle part	60 ,, δ	4	4·8	323 30	56 12
11. One in the lower part	64 ,, ϵ	4	5·2	323 37	57 25
The Heron.					
Grus.					
1. The head of the heron	18 γ	2	3·0	322 44	39
2. One in the neck	27 λ	4	4·7	325	41 5
3. The left wing	28 α	2	1·9	326 25	49
4. The second, in the neck	35 μ^1	4	5·0	327	43 25
5. The third, in the neck	43 δ^2	4	4·4	329 45	45 40
6. One near this	42 δ^1	5	4·2	329 15	45 35
7. The heart	57 β	2	2·2	335 12	49
8. One in the left leg	61 η	4	5·1	335 40	55 45
9. One above this, in the leg	68 ϵ	4	3·5	336 30	53
10. One in the tail	77 ζ	4	4·0	340 40	54 10
11. One in the right wing	84 θ	4	4·2	341 20	46 12
12. One other below this, in the wing	90 ι	4	3·9	341 50	48
The Indian Magpie, named by the Indians Lang.					
Tucana.					
1. One above, on the beak	26 γ	4	4·0	344	60 15
2. One in the body	?	5		351 20	65 30
3. Another one in this	43 η	5	5·9	353 10	66 36
4. One behind, in the left leg.	44 ϵ	5	4·3	355 35	68
5. One at the extremity of the body	49 ζ	5	4·1	0	67 24
6. One in the tail *	52 β	5	4·3	2 50	64 34

Comparison of Houtman's Declinations for Epoch A.D. 1600.

Star.	Houtman.	Neugebauer.	N.–H.
α Phœnicis	−44° 5′	−44° 30′	−25′
α Eridani	59 20	59 17	+ 3
θ ,,	41 50	41 56	− 6
α Columbæ	34 25	34 20	+ 5

* The position of 6 Tucanæ is correctly identified as 52 β, but it is not the star in the tail.

Comparison of Houtman's Declinations for Epoch A.D. 1600—continued.

Star.	Houtman.	Neugebauer.	N.-H.
	° ′	° ′	′
α Argus	52 15	52 30	−15
τ Puppis	49 55	50 11	−16
σ ,,	42 20	42 32	−12
ζ ,,	32 0?	38 55	
γ Velorum	46 25	46 11	+14
ε Carinæ	58 20	58 15	+ 5
δ Velorum	53 45	53 17	+28
λ ,,	42 2	41 52	+10
β Carinæ	67 30	68 5	−35
ι ,,	57 30	57 38	− 8
κ Velorum	53 45	53 20	+25
N ,,	55 31	55 17	+14
υ Carinæ	63	63 14	−14
θ ,,	62 20	62 19	+ 1
μ Velorum	48	47 19	+41
α Crucis	60 40	60 52	−12
γ ,,	54 48	54 52	− 4
β ,,	57 8	57 29	−21
δ Centauri	48 18	48 29	−11
γ ,,	46 48	46 45	+ 3
ι ,,	34 0	34 35	−35
ε ,,	51 15	51 24	− 9
ζ ,,	45 20	45 17	+ 3
β ,,	58 8	58 23	−15
θ ,,	35	34 22	+38
α Lupi	46	45 37	+23
α Centauri	58 48	59 7	−19
α Muscæ	66 30	66 55	−25
β Lupi	41 18	41 26	− 8
γ ,,	40 16	39 45	+31
η ,,	37 20	37 10	+10
γ Trianguli Austr.	66 48	67 3	−15
α ,,	68	68 9	− 9
μ^1 Scorpii	37 10	37 17	− 7
ζ^2 ,,	41 36	41 35	+ 1
η ,,	42 32	42 37	− 5
λ ,,	37	36 43	+17
θ ,,	42 38	42 38	0
κ ,,	38 45	38 44	+ 1

Comparison of Houtman's Declinations for Epoch A.D. 1600—continued.

Star.	Houtman.	Neugebauer.	N.–H.
	° ′	° ′	′
ι^1 Scorpii	39 50	39 53	− 3
ζ Aræ	54 40	55 14	−34
β ,,	55	55 2	− 2
α ,,	49 38	49 26	+12
α Pavonis	58 14	57 55	+19
α Gruis	49	48 51	+ 9
β ,,	−49	−48 57	+ 3

The Number of Stars of Different Magnitudes in the Hyderabad Astrographic Catalogue, Zone − 17°.

By R. J. Pocock, B.A., B.Sc.

1. The first volume of the *Hyderabad Astrographic Catalogue*, containing the diameters and measured co-ordinates of over 63,000 stars on plates with centres approximately in Decl. − 17°, is now completed. The numbers of stars recorded under different diameters have been counted, and the results are discussed in the present note. As the printing of the volume is not yet complete, it may be best to begin with a brief description of the Hyderabad practice in determining diameters.

2. As each star is measured an estimate of the diameter is made and entered on the measure sheets. Since each star is measured twice in different positions of the plate; two estimates of the diameter are made, and these are added together and the sum printed in the catalogue under the heading d (thus following the Greenwich plan). In order to convert these numbers into magnitudes a formula of the form $m = a - b\sqrt{d}$ has been adopted, since other observatories have found such a formula suitable. The numbers of stars of each tenth of a magnitude among the reference stars used for this zone, taken from the *Washington A.G. Catalogue*, were counted, and by means of these counts the Washington magnitudes were converted to a scale comparable with that of Chapman and Melotte.* These modified magnitudes (m) were then compared with the diameters (d) separately for each plate, and hence the constants a, b determined. Several different groups of plates gave values of b all close to 1·09, which was therefore adopted for the whole zone, and the values of a determined separately for each plate. The resulting formulæ, however, very often result in giving much too faint a magnitude for the fainter stars on the plate. This is due to the fact that most of the measurers used in reality two distinct scales, one for the bright stars and another for the faint stars, estimating all the stars as over 20 or under 10 say, with very few between, so that a formula determined

* See *Astronomical Journal*, vol. xxix., No. 688.