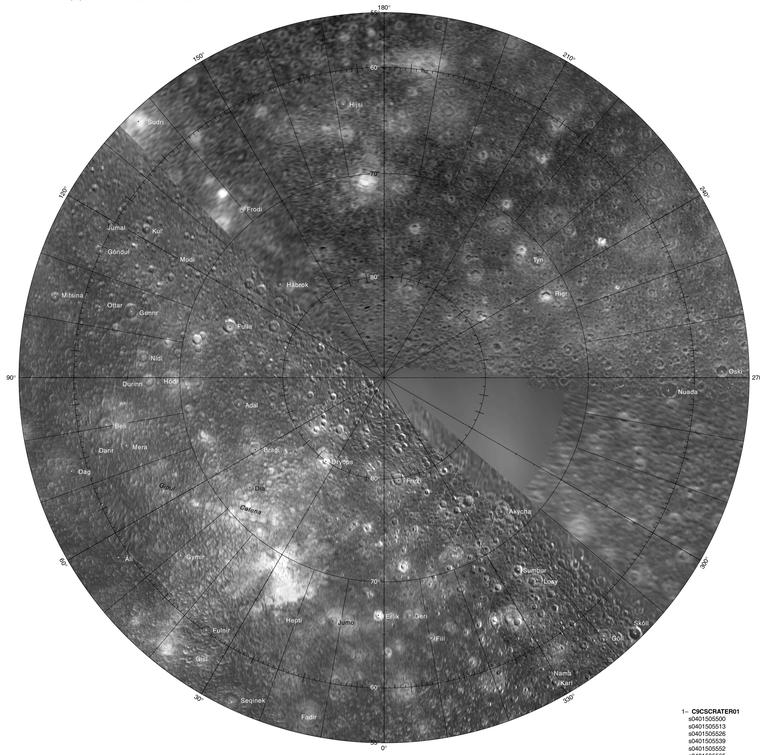
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared for the
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

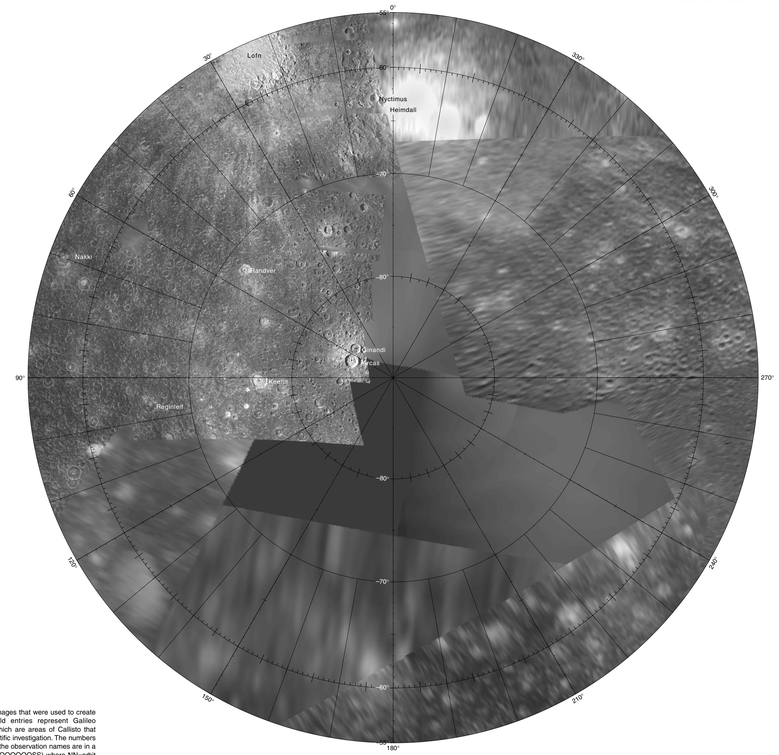
GEOLOGIC INVESTIGATIONS SERIES I–2770
ATLAS OF JOVIAN SATELLITES: CALLISTO



SCALE 1:8 388 000 (1 mm = 8.39 km) AT 56° LATITUDE
POLAR STEREOGRAPHIC PROJECTION

KILOMETERS

NORTH POLAR REGION



SCALE 1:8 388 000 (1 mm = 8.39 km) AT –56° LATITUDE
POLAR STEREOGRAPHIC PROJECTION

KILOMETERS

SOUTH POLAR REGION

Prepared by the International Astronomical Union. Names have been applied for features clearly visible at the scale of this map; for a complete list of nomenclature for Callisto, please see http://planetarynames.wr.usgs.gov. Font color was chosen only for readability.

NOTES ON BASE

This sheet is one in a series of maps of the Galilean satellites of Jupiter at a nominal scale of 1:15,000,000. This series is based on data from the Galileo Orbiter Solid-State Imaging (SSI) camera and the cameras of the Voyager 1 and 2 spacecraft.

PROJECTION

Mercator and Polar Stereographic projections used for this map of Callisto are based on a sphere having a radius of 2,409.3 km. The scale is 1:8,388,000 at ±56° latitude for both projections. Longitude increases to the west in accordance with the International Astronomical Union (1971) (Seidelmann and others, 2002).

CONTROL

The geometric control network was computed at the RAND Corporation using RAND's most recent solution as of April 1999 (Davies and Katayama, 1981; Davies and others, 1998). This process involved selecting control points on the individual images, making pixel measurements of their locations, using reseau locations to correct for geometric distortions, and converting the measurements to millimeters in the focal plane. These data are combined with the camera focal lengths and navigation solutions as input to photogrammetric triangulation software that solves for the best-fit sphere, the coordinates of the control points, the three orientation angles of the camera at each exposure (right ascension, declination, and twist), and an angle (Wp) which defines the orientation of Callisto in space. Wp—in this solution 259.51°—is the angle along the equator to the east, between the 0° meridian and the equator's intersection with the celestial equator at the standard epoch J2000.0. This solution places the crater Saga at its defined longitude of 326° west (Seidelmann and others, 2002).

MAPPING TECHNIQUE

This global map base uses the best image quality and moderate resolution coverage supplied by Galileo SSI and Voyager 1 and 2 (Batson, 1987; Becker and others, 1998; Becker and others, 1999; Becker and others, 2001). The digital map was produced using Integrated Software for Imagers and Spectrometers (ISIS) (Eliason, 1997; Gaddis and others, 1997; Torson and Becker, 1997). The individual images were radiometrically calibrated and photometrically normalized using a Lunar-Lambert function with empirically derived values (McEwen, 1991; Kirk and others, 2000). A linear correction based on the statistics of all overlapping areas was then applied to minimize image brightness variations. The image data were selected on the basis of overall image quality, resonable original input resolution (from 20 km/pixel for gap fill to as much as 150 m/pixel), and availability of moderate emission/incidence angles for topography. Although consistency was achieved where possible, different filters were included for global image coverage as necessary: clear for Voyager 1 and 2; clear and green (559 nm) for Galileo SSI. Individual images were projected to a Sinusoidal Equal-Area projection at an image resolution of 1.0 kilometer/pixel. The final constructed Sinusoidal projection mosaic was then reprojected to the Mercator and Polar Stereographic projections included on this sheet. The final mosaic was enhanced using commercial software.

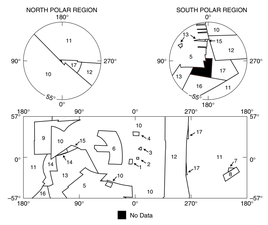
NOMENCLATURE

Names on this sheet are approved by the International Astronomical Union. Names have been applied for features clearly visible at the scale of this map; for a complete list of nomenclature for Callisto, please see http://planetarynames.wr.usgs.gov. Font color was chosen only for readability.

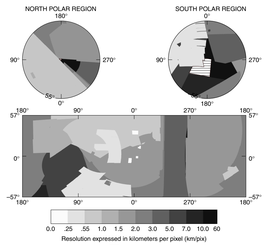
Jc 15M CMN: Abbreviation for Jupiter, Callisto (satellite): 1:15,000,000 series, controlled mosaic (CM), nomenclature (N) (Greeley and Batson, 1990).

REFERENCES

Batson, R.M., 1987, Digital cartography of the planets—New methods, its status, and its future: Photogrammetric Engineering and Remote Sensing, v. 53, no. 9, p. 1211–1218.
Becker, T.L., Archinal, B., Colvin, T.R., Davies, M.E., Gitlin, A., Kirk, R.L., and Weller, L., 2001, Final digital global maps of Ganymede, Europa, and Callisto, *in* Lunar and Planetary Science Conference XXXII: Houston, Lunar and Planetary Institute, abs. no. 2009 [CD-ROM].
Becker, T.L., Rosanova, T., Cook, D., Davies, M.E., Colvin, T.R., Acton, C., Bachman, N., Kirk, R.L., and Gaddis, L.R., 1999, Progress in improvement of geodetic control and production of final image mosaics for Callisto and Ganymede, *in* Lunar and Planetary Science Conference XXX: Houston, Lunar and Planetary Institute, abs. no. 1602 [CD-ROM].
Becker, T.L., Rosanova, T., Gaddis, L.R., McEwen, A.S., Phillips, C.B., Davies, M.E., and Colvin, T.R., 1998, Cartographic processing of the Galileo SSI data—An update on the production of global mosaics of the Galilean satellites, *in* Lunar and Planetary Science Conference XXIX: Houston, Lunar and Planetary Institute, abs. no. 1892 [CD-ROM].
Davies, M.E., and Katayama, F.Y., 1981, Coordinates of features on the Galilean satellites: Journal of Geophysical Research, v. 86, no. A10, p. 8635–8657.
Eliason, E.M., 1997, Production of Digital Image Models using the ISIS system, *in* Lunar and Planetary Science Conference XXVIII: Houston, Lunar and Planetary Institute, p. 331.
Gaddis, L.R., Anderson, J., Becker, K.J., Becker, T.L., Cook, D., Edwards, K., Eliason, E.M., Hare, T., Kieffer, H.H., Lee, E.M., Mathews, J., Soderblom, L.A., Sucharski, T., Torson, J., McEwen, A.S., Robinson, M.S., 1997, An overview of the Integrated Software for Imaging Spectrometers (ISIS), *in* Lunar and Planetary Science Conference XXVIII: Houston, Lunar and Planetary Institute, p. 387.
Greeley, R., and Batson, R.M., 1990, Planetary Mapping: Cambridge University Press, Cambridge, p. 274–275.
International Astronomical Union, 1971, Commission 16—Physical study of planets and satellites, in Proceedings of the 14th General Assembly, Brighton, 1970: Transactions of the International Astronomical Union, v. 14B, p. 128–137.
Kirk, R.L., Thompson, K.T., Becker, T.L., and Lee, E.M., 2000, Photometric modeling for planetary cartography, *in* Lunar and Planetary Science Conference XXXI: Houston, Lunar and Planetary Institute, abs. no. 2025 [CD-ROM].
McEwen, A.S., 1991, Photometric functions for photoclinometry and other applications: Icarus, v. 92, p. 298–311.
Seidelmann, P.K., Abalakin, V.K., Bursa, M., Davies, M.E., de Bergh, C., Lieske, J.H., Oberst, J., Simon, J.L., Standish, E.M., Stooke, P., and Thomas, P.C., 2002, Report of the IAU/IAG Working Group on Cartographic and Rotational Elements of the Planets and Satellites—2000: Celestial Mechanics and Dynamical Astronomy, v. 82, p. 83–110.
Torson, J.M., and Becker, K.J., 1997, ISIS—A software architecture for processing planetary images, *in* Lunar and Planetary Science Conference XXVIII: Houston, Lunar and Planetary Institute, p. 1443.



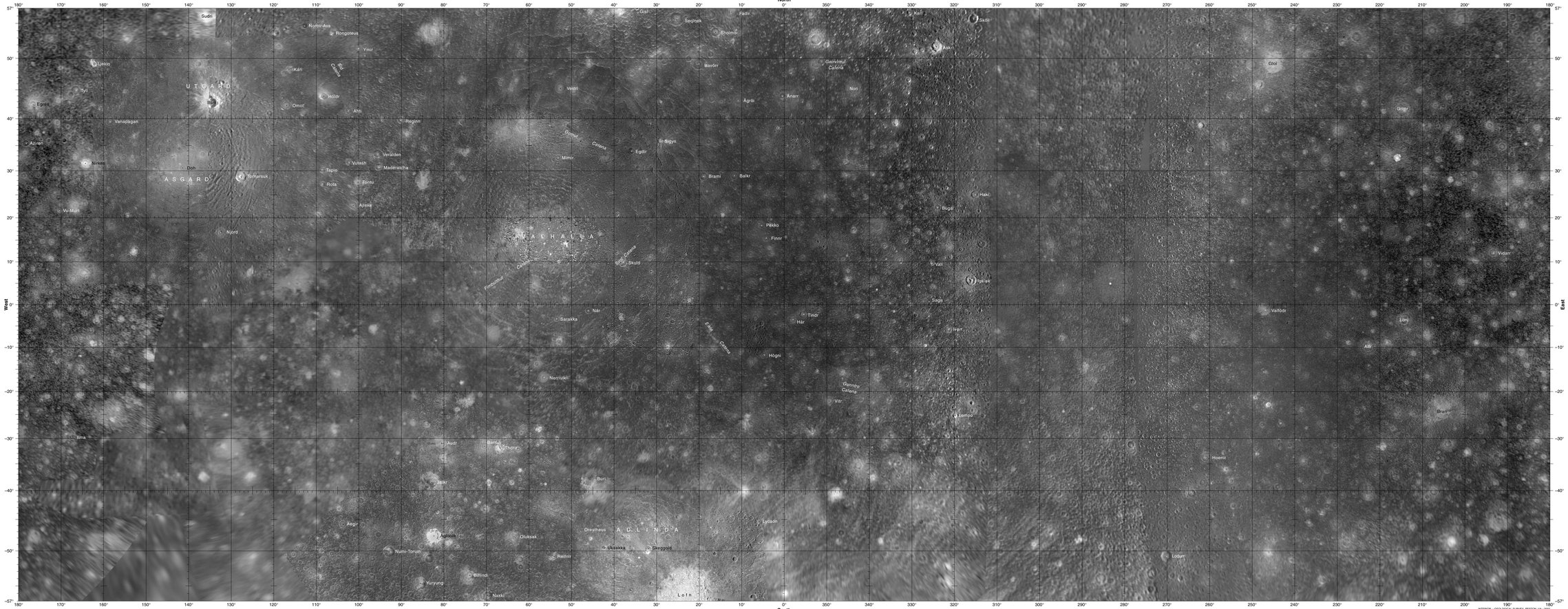
Footprint of the Galileo and Voyager image observation boundaries



Index showing approximate resolution of images included in the mosaic

Listed at left are the images that were used to create the photomosaic. Bold entries represent Galileo observation names, which are areas of Callisto that were targeted for scientific investigation. The numbers and letters included in the observation names are in a standard format (NNTIOOOOOOSS) where NN=orbit number, T=target (Callisto in this case), I=instrument, OOOOOO=sciencee targeting objective, and SS=sequence number. The numbers connected with these bold observation names correlate to the numbers on the index to the left and are listed in order of descending resolution. The 'S' and 'c' entries represent spacecraft clock times, which are used as unique archival identifiers for each image; they are listed in the order they were mosaicked.

1– **C9CSCRATER01**	s0394364268	s0394371368	s0394377545	8– **30CSBRANCR01**	c1642130	c1642520	c1642452	c2061346	s0368211900
s0401505500	s0394364300	s0394371400	s0394377589	s0605155800	c1642133	c1642512	c1642434	c2061725	s0368211901
s0401505513	s0394364322	s0394371422	6– **C9CSVALHAL02**	s0605155801	c1642136	c1642514	11– *Voyager 2*	c2061709	15– **11CSPHOTOM01**
s0401505528	s0394364345	s0394371448	s0401513300	s0605155900	c1642139	c1642516	c2061904	c2061334	s0420426101
s0401505539	s0394364368	s0394371468	s0401510565	s0605155901	c1642143	c1642518	c2061916	c2061330	16– *Voyager 2 Low*
s0401505552	s0394364400	s0394371500	s0401510400	9– **C3CSASGRNG01**	c1642147	c1642500	c2061921	c2061713	*Resolution Frame*
s0401505565	s0394364422	s0394371522	s0401510539	s0368289901	c1642151	c1642502	c2061932	c2061705	c2058321
2– **10CSSMTHFL02**	s0394364445	s0394371545	s0401510578	s0368289300	c1642155	c1642504	c2061936	c2061721	17– *Voyager 1 Low*
s0413388122	s0394364468	s0394371568	s0401510513	s0368289101	c1642159	c1642432	c2061940	c2061406	*Resolution Frames*
s0413388123	s0394364500	s0394371600	s0401510426	s0368289200	c1642211	c1642506	c2060621	c2061418	c1633208
s0413388145	s0394364522	s0394371300	s0401510478	10– *Voyager 1*	c1642225	c1642418	c2060625	c2061422	c1617415
s0413388168	s0394364545	s0394371322	s0401510552	c1641846	c1642646	c1642420	c2060629	c2061426	
3– **10CSTINDR_01**	s0394364568	s0394371345	s0401510452	c1641802	c1642801	c1642428	c2060633	c2061430	
s0413389500	s0394364600	s0394371368	s0401510413	c1641806	c1642510	c1642430	c2060637	c2061438	
s0413389501	s0394364622	s0394371400	s0401510526	c1641814	c1642526	c1642440	c2060641	12– **C2CSVGRGAP01**	
4– **10CSRNGSTR01**	s0394371268	s0394371422	s0401510500	c1641822	c1642450	c1642442	c2060645	s0360322900	
s0413389745	s0394371300	s0394371445	s0401510439	c1641838	c1642508	c1642444	c2060649	s0360323000	
s0413389746	s0394371322	s0394371468	s0401510465	c1642118	c1642524	c1642446	c2060653	13– **C7CSGLOBAL01**	
s0413389768	s0394371345	s0394377500	7– **20CSBRANCR01**	c1642121	c1642416	c1642448	c2061737	s0389556200	
5– **C8CSVGRGAP01**		s0394377545	s0498216345	c1642127	c1642426	c1642456	c2061741	14– **C3CSHEMCLR01**	



SCALE 1:15 000 000 (1 mm = 15 km) AT 0° LATITUDE
MERCATOR PROJECTION

KILOMETERS

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA—2002

Prepared on behalf of the Planetary Geology and Geophysics Program, Solar System Exploration Division, Office of Space Science, National Aeronautics and Space Administration

Manuscript approved for publication May 1, 2002

NOTE TO USERS

Users noting errors or omissions are urged to indicate them on the map and to forward it to the Astrogeology Team, U.S. Geological Survey, 2255 North Gemini Drive, Flagstaff, Arizona 86001. A replacement copy will be returned.

CONTROLLED PHOTOMOSAIC MAP OF CALLISTO

JC 15M CMN

2002

ISBN 0-607-99064-3

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