IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Center of Astrogeology
601 East Cedar Avenue
Flagstaff, Arizona 86001

May 31, 1967

Memorandum

To : Assistant Chief Geologist for Engineering Geology

From : Acting Chief, Branch of Astrogeology

Subject: Monthly report for Director and Secretary

1. Highlights and noteworthy results

Surface planetary exploration

A development vehicle, intended to simulate tasks performed by a lunar surface vehicle, was designed and constructed by R. A. Mills, B. G. Tinnin, and I. L. Wiser of the Field Test Systems project. The 4-wheel drive vehicle features electric and manual steering, provides for easy maneuverability with the driver in a space suit and, with the addition of another electric steering control unit, can be driven both forward and reverse equally well with the driver seated at controls at either end of the vehicle. It is to be used in the development and testing of lunar exploration procedures for post-Apollo missions.

Astrogeologic studies

Lunar Orbiter IV was launched from Cape Kennedy, Florida on May 4 and began its mission of photographing the entire moon from polar orbit. D. E. Wilhelms, K. A. Howard, H. A. Pohn, and M. H. Carr are acting as mission advisors at SFOF in Pasadena, California. The photographs are being evaluated by the lunar geologic mapping staff for the design of Mission V.

Large craters photographed by Lunar Orbiter IV in the eastern hemisphere show immediate steps in size and in age sequence that add significantly to an understanding of large craters with increasing crater size, central peaks are replaced by a ring of massive hills enclosing an inner basin, as in some mare basins. The transition occurs and crater sizes are between 100 and 300 km. Some craters in this size range show central rings enclosing inner basins and central peaks.

The large fresh crater Humboldt shows a nearly perfect radial and concentric arrangement of extension cracks on its floor, apparently caused by isostatic upwarping. The cracks are mostly restricted to smooth plains-forming material, and only rarely extend into an underlying hummocky floor unit or central peak complex, suggesting different cohesion of the units. The hummocky unit appears to be composed of chaotic blocks that overlie the massive central peak. Pools of dark mare along the outer margin of Humboldt's floor postdate the cracking and upwarping.

4. Outside publications reported during month:

Brett, Robin, and Higgins, G. T., 1967, Cliftonite in meteorites: a proposed origin: Science, v. 156, no. 3776, p. 819-820.

5. Personnel

The following employees entered on duty

Flagstaff, Arizona

Carolyn M. DeSilva, Mathematician
Karen J. Dixon, Clerk-Typist
Jack B. Fife, Computer Programmer
Richard L. Swenson, Research Physicist

Menlo Park, California

Robert B. Bennett, Geologic Field Assistant
James G. Hawley, Geologic Field Assistant
Mark N. Lawry, Geologic Field Assistant

Washington, D. C.

Judith A. Girdlinski, Physical Science Technician

Bellingham, Washington

Charles A. Ross, Geologist

Boulder, Colorado

Robert D. Watson, Physicist

Transfers

Harvey E. Belkin, Physical Science Technician, transferred to Regional Geology
Orrindates Mauran, Civil Engineering Technician, transferred to Naval Shipyard, Vallejo, California
Barbara A. Shields, Clerk-Stenographer, transferred to U. S. Geological Survey, Phoenix, Arizona

Resignations

Harold E. Atha, Carpenter, Flagstaff, Arizona
Maryellen Bailey, Clerk-Stenographer, Flagstaff, Arizona
James T. Beck, Geologic Field Assistant, Flagstaff, Arizona
Duke P. Brittain, Physical Science Aid, Flagstaff, Arizona
Wayne A. Cooksey, Engineering Aid, Flagstaff, Arizona
Pamela E. Dewey, Geologic Field Assistant, Flagstaff, Arizona

6. Scientific meetings or conferences attended at home or abroad

H. L. James, D. R. Nichols, E. M. Shoemaker, M. L. Troyer, A. H. Chidester, and Harold Masursky met with C. W. Hess, Director of Space Sciences, Manned Spacecraft Center, Houston, Texas, to outline the long range goals and areas of mutual interest in space science activities

E. M. Shoemaker, M. L. Troyer, A. A. Honka, A. H. Chidester, G. A. Swann, J. W. M'Gonigle and D. H. Dahlem visited Manned Spacecraft Center, Houston, Texas, for budget discussions and review of work to date.

Harold Masursky and D. R. Wilhelms attended the review of the Lunar Orbiter V orbital design at Jet Propulsion Laboratory, Pasadena, California.

Harold Masursky spoke at the initial press conference on Lunar Orbiter IV at Jet Propulsion Laboratory, Pasadena, California.

P. R. Brett visited Dr. C. W. Hess and Dr. E. A. King, Manned Spacecraft Center, Houston, Texas, to discuss establishing a geochemical laboratory.

Jerry Harbour visited the Grumman Aircraft Engineering Corporation, Bethpage, Long Island, New York with a group of people from the Survey to see and hear the presentation on the earth resources program and to consult with them on their lunar surface vehicle simulator.

E. C. T. Chao visited Dr. Wolfgang Haller and Dr. P. B. Macedo of the National Bureau of Standards, Washington, D. C. to discuss nucleation in glass and structure of glass of different critical cooling rates.

M. H. Hait and G. A. Swann visited the Human Engineering section at Manned Spacecraft Center to participate in metabolic studies in pressure suits.

P. E. Krauss attended a four day teleprocessing seminar held jointly in Washington, D. C. by IBM and U. S. Geological Survey Computer Division for the purpose of informing those persons responsible at the field sites, in depth, of plans and requirements necessary for the installation and subsequent use of the terminal computers for transmission and receipt of programs and data.

7. Talks or papers presented at meetings

Speaker and organization	Subject
Max L. Troyer American Institute of Mining Engineers Prescott, Arizona	Astrogeology
J. F. McCauley University of South Carolina Columbia, South Carolina	Series of lectures on lunar stratigraphy and results of Ranger, Surveyor and Lunar Orbiter programs
H. J. Moore Montana State University Bozeman, Montana	Geology of the moon as seen through Lunar Orbiter, Surveyor and Luna 9 photographs
H. J. Moore Astronomy Class Stanford University Stanford, California	Geology of the moon
H. J. Moore Geology Class Stanford University Stanford, California	Geology of the moon
H. J. Moore Green Gables Kindergarten Class (two sessions) Palo Alto, California	The world is made of rocks
R. D. Regan History Class Flagstaff High School Flagstaff, Arizona	U. S. Geological Survey
R. D. Regan Annual convention of the Arizona Federated Garden Club Sedona, Arizona	The Gemini and Apollo programs
D. W. Hart Flagstaff Women's Club Flagstaff, Arizona	The role of the Astrogeology Branch

8. Visitors

Visitors	Visited and purpose
Dr. G. G. Kennedy University of California Los Angeles, California and Mrs. Ursula Marvin Smithsonian Astrophysical Observatory Cambridge, Massachusetts	P. R. Brett-discussed the origin of cliftonite and diamonds in meteorites
Dr. R. G. Brereton and J. D. Burke Jet Propulsion Laboratory Pasadena, California	J. F. McCauley for a tour of Meteor Crater
Professor Donald Colquhoun University of South Carolina Columbia, South Carolina	J. F. McCauley--discussed lunar mapping
Dr. John F. Lovering National Australian University Canberra, Australia	E. C. T. Chao--discussed shock-induced temperature rise in meteoritic iron; and the 0.8 to 0.9 million K-A ages of Australasian tektites
Dr. A. J. A. Janse Selection Trust Exploration Ltd. London, England	D. E. Stuart-Alexander, D. J. Milton, and H. J. Moore--discussed American occurrences of explosive intrusions
Bruno E. Sabels Bellcomm, Inc. Washington, D. C.	Gordon A. Swann--discussed lunar hand tools and television test
J. D. Burke, Dr. R. G. Brereton, R. Coryell and J. R. Bruman Jet Propulsion Laboratory Pasadena, California	John W. M'Gonigle--discussed lunar exploration
Professor J. C. Harrison Geology Department University of Colorado Boulder, Colorado	H. L. Krivoy--discussed local geology and geological and geophysical facilities in the region
Oak Creek Canyon Camera Club Sedona, Arizona	Tour of facilities by H. G. Stephens and J. R. McCord

Dr. Stanley S. Beus, Chairman Geology and Geography Department Northern Arizona University Flagstaff, Arizona and Dr. Theodore Downs Chief Paleontologist Los Angeles County Museum Los Angeles, California	Tour of facilities by Russell Wahmann
High School Students Coolidge, Arizona	Tour of facilities by H. G. Stephens and Russell Wahmann
Geology Students Ormes School Mayer, Arizona	Tour of facilities by H. G. Stephens and A. E. Dale
Chaffey College Students Alta Loma, California	Tour of facilities by A. E. Dale and Russell Wahmann
Horseless Carriage Club of America Phoenix, Arizona	Tour of facilities by Russell Wahmann and A. E. Dale
Luke Air Force Base personnel Phoenix, Arizona	Tour of facilities by H. G. Stephens

General Information

Surface planetary exploration

Astronaut training

Field exercises involving 21 astronauts were held at Zuni Salt Lake volcanic crater in New Mexico; Hopi Buttes volcanic field, Arizona; and Meteor Crater, Arizona. Exercises were under the leadership of E. M. Shoemaker, David Cummings and R. L. Sutton. The trip stressed a variety of volcanic features and the genesis and morphology of craters.

Early Apollo investigations

Early Apollo geological methods

A television feasibility test was held at the Hoskietso diatreme, in the Hopi Buttes north of Holbrook, Arizona. The purpose of the test was to evaluate and demonstrate the need for real-time television during lunar exploration. The test involved the simultaneous video tape recording of surveillance and hand-held television cameras during a 2-hour Apollo-type traverse.

Both television cameras proved extremely useful. For example, the surveillance camera gives a continuous view of the test subject's progress, reduces the amount of verbal information the subject must relay by providing pictures of the broad terrane framework into which the Data Facility can put geologic data, and helps the Data Facility advise the subject on advantageous changes in a preplanned traverse.

The hand-held camera complements the surveillance camera. First, the hand-held camera provides a continuous detailed record of the subject's traverse and shows the geologic information at essentially the same scale as seen by the subject, thus reducing effort and saving time on descriptions. Second, the hand-held camera shows important geologic relationships not seen by the surveillance camera and which are otherwise very difficult and time consuming to relay verbally.

H. D. Ackermann has started field work on seismic studies of explosion craters. The first project area is Cinder Lake, a broad, relatively smooth cinder flat, northeast of Flagstaff. Cinder Lake comprises 20 feet or more of cinders overlying lava; locally, the lava crops out.

Preliminary tests included one to determine a system to perform detailed shallow seismic studies in cinders where the near-surface acoustic velocity is less than in air, and another to determine the amount and depth of explosives needed to produce suitable craters.

A charge of 100 pounds of nitro-carbo-nitrate and $11\frac{1}{2}$ pounds of 60% gelatin dynamite produces a crater about 5 feet deep and 24 feet wide.

The first crater for study will be made where the layering down to and including the lava is horizontal. For this spot, several locations were studied seismically and a suitable area was found where the lava is 40 feet below the surface.

The next steps will include, first, a detailed seismic survey to define the subsurface layering; second, cratering; and third, a detailed resurvey to determine the effect of the crater on the layering.

Early Apollo photogrammetry

R. M. Batson used the Gemini Hasselblad camera on loan from Manned Spacecraft Center, Houston, Texas, to take six stereo pairs of cinders and jagged lava at Bonito Flow north of Flagstaff. He has tentatively concluded that stereopsis with a 6-foot baseline is very good beyond 10 feet, but stereoscopic fusion of closer images is difficult. Extreme near-field stereo is best accommodated with short baseline stereo pairs.

Next, Batson will set up the stereo pairs in an analytical plotter to remove parallax and get relative orientation, and then use this data to set up the stereo pairs in the A-5 plotter for preliminary topographic contouring practice.

Mission planning

A mission planning exercise was held in which planning problems for Early Apollo missions were discussed in relationship to the geology and terrain of three representative potential landing areas within the Apollo belt of interest. Preliminary geologic maps based on high resolution Lunar Orbiter photography were prepared and discussed by E. A. Holm, S. A. Titley, and T. N. V. Karlstrom. The resulting discussion emphasized extant problems in providing large-scale geologic maps for use by the astronauts, and the possibility that instead of maps a prepared plate showing illustrations of the representative small-scale mare features which are likely to be encountered by the astronauts during the first lunar landings may prove more useful. It was decided to continue experimentation with both approaches. Examples of both the large-scale maps and the representative-feature plates for potential landing ellipses will be prepared and used as a basis for more detailed geologic planning at the next meeting of the mission planning group which will be expanded to include all interested Branch personnel. This preliminary exercise proved most useful in delineating the area where more information is needed for proper mission planning.

Supporting projects

J. D. Crossen completed a course in Geodesy given by the Topographic Division in Menlo Park, California, and is currently enrolled in their Advanced Photogrammetry course.

A 14-minute film entitled Apollo Applications Test 8 has been completed by the unit and released. This sound film is in color and deals with the testing of a vehicle-mounted gyroscope navigation system for possible application in geological exploration on the lunar surface.

Geophysical research

Reconnaissance gravity field work by J. D. Hendricks in the SP Quadrangle, Arizona, has been completed with reduction of that data now under way.

Astrogeologic studies

Reduction of Orbiter pictures continues. A significant inconsistency between area covered by the pictures and the NASA supply timing and tracking data has been noted. This inconsistency could be caused by an error in either the altitude or the distance between camera stations.

A fission track dating laboratory is being established at Menlo Park, California and work has started on the development of the techniques for the dating of volcanic glasses by the fission track method.

The U. S. Geological Survey's IBM 360/65 computer in Washington, D. C. is operational and is currently processing programs transmitted from Flagstaff, Arizona; Menlo Park, California; Denver, Colorado; and Rolla, Missouri, along with Washington-generated programs.

D. J. Roddy reports that NX core drilling is in progress at Flynn Creek, Tennessee.

L. C. Rowan has proposed a program for testing the interagency consistency of the photoclinometric and photogrammetric slope measuring and profiling techniques on Lunar Orbiter photography.

A 1:50,000 scale geologic map of part of the floor of Alphonsus (RLC 15), has been completed by J. F. McCauley and is undergoing technical review. The map shows the distribution patterns of four floor-filling units of differing age, four distinct crater units and three types of crater rims. The craters and associated rim units are both of impact and volcanic origin.

R. L. Wildey and N. J. Trask have examined the month-to-month dispersion in degree of polarization at constant phase angle for a possible correlation with the moon's true anomaly (essentially time since perigee passage) and find that no correlation exists. The source of the dispersion remains a mystery.

W. C. Saslaw (Jesus College, Cambridge University) and R. L. Wildey have examined the photo-chemistry of Jupiter's upper atmosphere from the ion-molecule viewpoint. In the system of chemical equations developed, very few reaction cross-sections are known. Circumvention of this problem by assuming thermodynamic equalibrium seems unwarranted by the physical conditions. Use of a highly simplified model for the production of ethylene and some estimated cross-sections produces an abundance of ethylene seven orders of magnitude too small to produce an infrared opacity sufficient to explain Wildey's hot shadow effect (enhanced radiation from Jovian regions in eclipse by the Galilean satellites).

A. J. Swartz has selected an empirical function which will closely represent the H and D curve in the operational photoclinometry project. Either a table plus high order interpolation will be used or else a combined exponential-linear-reciprico-exponential curve.

R. L. Wildey has suggested a possible solution to the problem of the systematic photometry error in Lunar Orbiter photography that is dependent on fram coordinate. This error appears to depend on one coordinate only--that is, it is stratified. Most of the time the directional trend of this error is not close to the direction in which a photometric profile is required to be taken. By using the laser spatial filtering technique with a filtering diaphragm in the form of a sector of a circle set in a direction perpendicular to the error stratification, it may be possible to filter out all frequencies except the DC level in this direction without disturbing the true brightness variations in the direction of the photoclinometric profile. Further investigation is needed. The separation of DC from first harmonic is difficult with regard to filter adjustment, and extra care not to increase photographic-photometric errors is also required.

Preliminary reconnaissance revealed the presence of peridotite and possible eclogite xenoliths in the youngest basalt flows in the Lunar Crater field. Large pyroxene and plagioclase xenocrysts were also found in new lava erupted from the Lunar Crater maar.

Two computer programs are to be used eventually in photoclinometry: (a) a program now being developed in the Survey by A. D. Swartz and J. W. Ridgley; (b) a program already available from the Langley Research Center. For each one of these two programs, procedures for indexing and measuring the x-y coordinates of scanning site starting points on 35 mm Orbiter film have been established, and the parameters needed for locating traverses and scanning have been defined.

Frank Cuttitta reports that work continues on: (a) major element analyses of 18 samples from Crater 160, San Francisco Volcanic Field, Coconino County, Arizona; (b) major element analyses of 19 samples of metamorphosed rock from Bosumtwi Crater, Ghana; and (c) radiochemical analyses for Cs, Hf, and Ta in meteorites and achondrites in connection with differential volatilization studies. Using emission spectroscopy, other volatilization studies, now in progress, concern the trace alkalies (Li, Rb, and Cs) Ag, Bi, Nb, Pb, Zn, and Zr in tektites and crater materials.

Two mineral inclusions from Thailand tektites were qualitatively analyzed with the electron probe by E. J. Dwornik and shown to contain essentially silica. This information agrees with the scanty optical data that such inclusions are probably quartz. Many more wafers containing mineral inclusions are being made for continued study of inclusions that may not be quartz.

E. C. T. Chao began the study of experimentally shocked Lake County calcic labradiorite specimens. Two lots: those shocked to approximately 140 kb show abundant microfracture, although the material is milky white, they show no detectable change in optical properties; the other lot shocked approximately to 280 kb, the material is translucent to transparent and is nearly isotropic with an index of refraction of 1.552 which is appreciably lower than the unshocked control sample. The densities of various fragments as well as detailed optical and X-ray studies will be done. A large number of measurements using two separate Berman precision micro-balance show variable results of supposed homogeneity. Because of the need of accurate measurement (significant figure to third decimal place) detailed calibration of specific gravity measuring techniques on milligram samples are being undertaken.

R. D. Regan, J. H. Hassemer, and J. M. Herskovits have successfully completed the IBM programmed instruction course in Fortran IV for the IBM System 360.

H. E. Holt spent the past $4\frac{1}{2}$ weeks involved in Surveyor Mission III. Last week was spent at Cape Kennedy, Florida with calibrations for S/C IV.

W. T. Borgeson is helping the Photomechanical Lab obtain more exact enlargements more rapidly by calculating printer scale setting tables based on the measured relationship between scale setting and lands formula distances. These tables will be refined by corrections obtained from measurements of test exposures of a measured master.

W. T. Borgeson, with four men from Manned Spacecraft Center, Houston, Texas, attended a conference at the Hasselblad plant in Goteborg, Sweden and at Carl Zeiss, Overkocken, Germany. This

meeting, a final design review for the Apollo fixed frame camera, covered many matters of which only the (1) fiducial mark and (2) polarizing filters are of direct interest. The following has been established: 1. Fiducial marks. At least four corner marks will be provided; they will be fixed to the camera body. Implementation has not been decided but a likely candidate is a very small collimator (diameter less than 5 mm) that Zeiss is presently installing in its cartographic cameras. 2. Polarizing filters. A three position removable holder will be employed. The positions will be top 45° left of top 45° right of top.

Lunar geologic mapping

A new compilation of the geology of the lunar equatorial belt (longitude 70°E - 70°W, latitude 32°N - 32°S) at a scale of 1:5,000,000 is being prepared by D. E. Wilhelms, D. B. Burke and J. F. McCauley. The compilation will be published and will supersede the preliminary version prepared in July 1965. Approximate date of completion in Branch is October 1967.

All mapping of quadrangles at a scale of 1:500,000 has been discontinued except for one map near completion and maps being made by students and others at no cost to the Survey.

Apollo site maps for Manned Spacecraft Center, Houston, Texas: work on the map of Site 3P2(1P1) reported last month to have been begun by T. W. Offield, has been stopped at least temporarily because Manned Spacecraft Center does not now require the map. The site will be mapped in the future if Lunar Orbiter 5 supplies high resolution photographs of it.

An additional topical study from Orbiter photographs has been begun: structures south of Arago by E. A. Holm.

LUNAR GEOLOGIC MAPS

REPORT FOR MONTH OF May

			PRELIMINARY MAPS						FINAL MAPS							
	ACIC Bases Received	Author's Geological Work in Progress % Compl	Cartography - Scribing & Assembly in Progress	1st Composite Completed	1st Explanation Compl.	Map in Technical Review (Branch)	2nd Composite Completed	2nd Explanation Compl.	Geology Revision in Prog. % Completed	Cartography - Final Map Preparation	Map in Technical Review (Branch)	Authors' Revision in Progress, % Completed	Submitted to APD	Director's Approval Received	Transmitted to BMR	Published
Equatorial Belt																
ARISTARCHUS LAC 39	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
BYRGIUS LAC 92	X	100	X	X	X	X	X	X								
CLEOMEDES LAC 44	X	100	X	X	X	X	X	X	100	X	X	50				
COLOMBO LAC 79	X	100	X	X	X	X	X	X	100	X	X	60				
COPERNICUS LAC 58	X	100	X	X	X	X	X	X	100	X	X	100	X	X		
FRACASTORIUS LAC 97	X	100	X	X	X	X	X	X								
GRIMALDI LAC 74	X	100	X	X	X	X	X	X	10							
HEVELIUS LAC 56	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
JULIUS CAESAR LAC 60	X	100	X	X	X	X	X	X	100	X	X	100	X	X		
KEPLER LAC 57	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
LANGRENUS LAC 80	X	100	X	X	X	X	X	X	5							
LETRONNE LAC 75	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
MACROBIUS LAC 43	X	100	X	X	X	X	X	X	100	X	X	30				
MARE HUMORUM LAC 93	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
MARE SERENITATIS LAC 42	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
MARE UNDARUM LAC 62	X	100	X	X	X	X	X	X								
MARE VAPORUM LAC 59	X	100	X	X	X	X	X	X	100	X	X	100	X			
MONTES APENNINUS LAC 41	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
MONTES RIPHAEUS LAC 76	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
PETAVIUS LAC 98	X	100	X	X	X	X	X	X								
PITATUS LAC 94	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
PTOLEMAEUS LAC 77	X	100	X	X	X	X	X	X	100	X	X					
PURBACH LAC 95	X	100	X	X	X	X	X	X	15							
REPES ALTAI LAC 96	X	100	X	X	X	X	X	X	10							
SELLUCUS LAC 38	X	100	X	X	X	X	X	X	100	X	X	100	X	X		
TARUNTIUS LAC 61	X	100	X	X	X	X	X	X	35							
THEOPHILUS LAC 78	X	100	X	X	X	X	X	X	100	X	X	100	X			
TIMOCHARIS LAC 40	X	100	X	X	X	X	X	X	100	X	X	100	X	X	X	X
Northern Hemisphere (32°N - 64°N)																
ARISTOTELES LAC 13		20														
CASSINI LAC 25		100	X	X	X	X	X	X								
EUDOXUS LAC 26		90														
GEMINUS LAC 27		5														
J. HERSCHEL LAC 11		100	X	X	X	X	X	X								
PLATO LAC 12	X	100	X	X	X	X										
RUMKER LAC 23		90														
SINUS IRIDUM LAC 24		100	X	X	X	X	X	X								
Southern Hemisphere (32°S - 64°S)																
CLAVIUS LAC 126		70														
HOMMEL LAC 127																
MAUROLYCUS LAC 113		100	X	X	X	X	X	X								
RHETTA LAC 114	X	100	X	X												
SCHICKARD LAC 110																
SCHILLER LAC 125		5														
TYCHO LAC 112		35														
WILHELM LAC 111		5														

Ranger geologic maps

Report for the month of

May, 1967

RLC Number	Author's geologic work in progress-- % complete	Map compilation by drafting	Review of preliminary map	Preliminary copy to JPL	Final version in Technical Review	Final map to APU	Director's Approval	Transmitted to BMR	Published
2	75								
3	10								
7	100	x	x	x					
9	100	x	x	x					
14	100	x	x						
15	100	x							