**Academic Program Review: Self-Study**

***Instructions:*** *The following pages will guide your submission of your academic program review self-study. Please type your responses directly into the document. The completed self-study instrument and all attachments must be submitted to the Academic Program Review Coordinator and your Academic Dean by September 1.*

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| **Program Under Review** |
| Degree(s): Associate of Science in Geology and Planetary Science |
| Certificate(s): N/A |
| Contact Information for lead on Self-Study:  Name: Wayne Pryor  Campus: SPC  Phone: x5351  Email: wayne.pryor@centralaz.edu |

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| **Program Description, Vision and Outcomes** |
| What is the description of the program as stated in the current CAC catalog:  The Associate of Science in Geology and Planetary Science Degree prepares students to transfer to a university to earn a  baccalaureate degree in Geology or a related field. |
| Does your program have any other written mission or vision statements which do not appear in the catalog? If yes, please write them below and indicate where they appear.  N/A |
| Describe how the program’s description, mission and/or vision aligns with the College’s Mission:  Part of the college's mission is to prepare students to be on track for transfer to their desired four-year programs, which in this case includes not only geology but also planetary science and other earth-science related fields. Another aspect of the college's mission is job training; this program provides preparation for careers in mining and the energy industry. |
| What are the student learning outcomes for the degree or certificate as currently indicated in ACRES:  1. (Comprehension Level) Explain the basic natural laws and principles upon which the science of geology is based, including demonstrating the application of mathematical techniques, physical and chemical principles, and computer techniques related to geology.  2. (Evaluation Level) After physically examining common igneous, sedimentary and metamorphic rocks, determine their mineral composition and texture. Using this information, identify the samples and explain how these rocks formed.  3. (Evaluation Level) After physically examining various mineral samples, determine a variety of physical properties of minerals, including hardness, cleavage, luster and streak. Using this information, identify the minerals. Demonstrate knowledge of the most important minerals and energy sources used by humans  4. (Analysis Level) Identify a select group of common fossils and describe their methods of preservation.  5. (Evaluation Level) Using geologic maps, determine rock types and ages. Also determine the strike and dips of the beds, and identify different geologic structures. Demonstrate skill with maps, including topographic maps, geologic maps, and geologic cross-sections.  6. (Comprehension Level) Describe the historical development of modern geologic thought. Demonstrate knowledge of the history of the Earth and the evolution of life.  7. (Synthesis Level) Demonstrate knowledge of the major physical features of the Earth, including the Earth's internal structure, features of continents, ocean basins, and those produced by the tectonic and hydrologic systems. Also, describe the sources of energy that drive these systems and the Earth features produced by their operation over long periods of geologic time. Demonstrate understanding of the Earth's key geologic processes, including plate tectonics, the rock cycle, and the water cycle.  8. (Evaluation Level) Summarize the basic components of the hydrologic and tectonic systems. Describe the sources of energy that drive these systems and the Earth features produced by their operation over long periods of geologic time. Compare these systems to those operating on other planets.  9. (Evaluation Level) Summarize the basic components of the hydrologic and tectonic systems. Describe the sources of energy that drive these systems and the Earth features produced by their operation over long periods of geologic time. Compare these systems to those operating on other planets.  10. (Synthesis Level) Summarize the major geologic hazards faced by humans and how they can avoid them. List the major mineral and energy resources used by humans and describe their geologic occurrence. Describe some of the basic relationships that exist between humans and the Earth upon which they live. Show how the choices they will make are related. Demonstrate awareness of human effects on the Earth and its climate.  11. (Analysis Level) Explain the differences between relative and absolute geologic dates and be able to determine relative dates from a block diagram. Identify the major portions of the geologic time scale and explain how this great expanse of time was divided into smaller periods.  12. (Synthesis Level) Explain the differences between relative and absolute geologic dates and be able to determine relative dates from a block diagram. Identify the major portions of the geologic time scale and explain how this great expanse of time was divided into smaller periods and how absolute dates were determined for these periods.  13. (Synthesis Level) Describe some of the current scientific theories regarding the origin of the Earth, list the major advances in the chronological development of life upon the Earth and relate these to the major periods of the Geologic Time Scale and the theory of organic evolution. |
| Are the outcomes from your program determined or influenced by any external organization, agency, or accreditor? If so, please explain. |

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| **Program Enrollment and Graduation Trends** |
| Summarize the program enrollment data for the past 5 years in the chart below: (from Fact Book)  The program became available in Fall 2012. One student enrolled in and completed this program in 2014-2015. Enrollment data has been requested from I.R.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Degree/Certificate | 2014-15 | 2013-14 | 2012-13 | 2011-12 | 2010-11 | | A.S. - Geology and Planetary Science | 1 | 0 | 0 | N/A | N/A | |  |  |  |  |  |  | |
| Discuss and explain the factors influencing the enrollment trends:  This is a new program, and thus the college has not yet obtained enough data to enable any meaningful analysis.  Geology remains a popular major nationally and at Arizona Universities. The program is mathematically and scientifically rigorous, and will attract a few of CAC's best students in coming years. |
| How has the program typically recruited students and marketed the program:  (1) The catalog. (2) Advising. (3) Professors and STEM staff speaking to classes and giving handouts including discussions of related career opportunities in our fields. (4) STEM nights at the College. (5) Course flyers distributed around the college and in local public libraries. (6) Electronic billboard advertising.    . |
| Summarize the program graduation rate trends for the past 5 years in the chart below: (from Fact Book)  This is an increasing trend in a sense, because this is a new program.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Degree/Certificate | 2014-15 | 2013-14 | 2012-13 | 2011-12 | 2010-11 | | A.S. - Geology and Planetary Science | 1 | 0 | 0 | N/A | N/A | |  |  |  |  |  |  | |
| Discuss and explain the graduation trends. What efforts has the program made to help students achieve completion?  To help our one student complete the program on time, we offered a special 1-student section of Physical Geology in Spring 2015. We are also offering supplemental instruction funded from the STEM grant to support our math and chemistry courses, required for this program. |

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| **Program Curriculum:**  *Submit a completed Curriculum Comparison Chart along with the self-study, comparing the CAC program curriculum to three similar programs, for each Degree and Certificate discussed in this self-study. Ideally compare to other Arizona programs, and out of state if necessary.* |
| Using information gained from your curriculum comparisons, discuss the strengths and weaknesses of the current program curriculum for each degree or certificate.  A strength of our program is availability of the college's large observatory at SPC for astronomy classes and for public astronomy nights. We also recently equipped Maricopa for astronomy and geology and began offering our courses there. Astronomy is also offered at the SMC campus, and geology classes are offered at San Tan, SMC, and in Superior.  Our geology program also benefits from frequent field trips to sites around Arizona such as the Grand Canyon and Colossal Cave. The earth sciences remain field sciences, and this is a key part of our program, and we are grateful for the college's continued support of these trips. The small class sizes at community colleges are ideal for field trip programs.  The number of students who complete our A.S. program is likely to remain low, because of the rigorous requirements to complete geology, astronomy, chemistry, and physics coursework along with math through calculus. We are gradually expanding our science offerings around the district, but not all of these courses are currently available at all of our locations.  Our geology and astronomy courses primarily serve the function of providing lab science credits to non-science students, as part of their general education requirements. Several of our former geology and astronomy students are now teaching in the local K-12 school districts.  While geology and astronomy courses are taught at community colleges around the state, other schools do not have an A.S. degree in geology and planetary science exactly like ours. The attached comparison chart compares our program to several similar programs that provide an A.S. in geology. We think that having our A.S. degree in the catalogue will help interested students find and take the appropriate courses to lead them to future success in University geology and related programs. |
| Discuss how the program gets feedback on its program and curriculum from external sources, suchas advisory boards, employers, articulation task forces, accreditors, etc.  We attend the Geology ATF meetings to remain current in what is happening around the state. One useful fact we learned there is that changing the course called "Environmental Geology" to "Hazards and Disasters" would increase enrollment. We are trying this change here at CAC, with the new name in effect Fall 2015. We also attend national meetings of the American Geophysical Union and the American Astronomical Society to obtain new ideas on how to improve our courses. |
| Indicate any external accreditations which the program has. Are there any available accreditations which the program does not have, but maybenefit from seeking?  N/A |
| Discuss how the program supports current or future needs for the job market in Pinal County, the state of Arizona, and/or the United States.  Geology and related programs remain popular nationally. The Bureau of Labor Statistics predicts 15.8% growth in the number of geoscientists by 2022 compared to 2012 levels. The energy and mining industries hire many graduates; while others pursue high school or college teaching positions. Governments at all levels hire earth scientists in a variety of roles. |
| For degree programs, identify any specific in-state baccalaureate programs into which this program is particularly suited for transfer:  The program is suitable for all four-year universities, especially for those in Arizona. |
| Indicate any articulation agreements in place for degree graduates.  Arizona State University – An articulation agreement is in place as part of a grant shared by ASU and CAC that is providing support for our geology programs in the Superior area. |

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| **Program Specific Resources:**  *In this section please focus on program specific resource. You may but do not have to discuss resources available to the college at large such as Blackboard, the Learning Centers, Library, etc. However, if these resources are impacting your program in a positive or negative way which you would like to discuss, please do so.* |
| Discuss the adequacy of the financial and budgetary resources available to the program over the past 5 years:  The opening of the Maricopa campus was accompanied by adequate funding to equip an astronomy and geology classroom. A retired geology professor provided us with a wonderful specimen collection for that campus. We moved the college's 20-inch Dobsonian telescope to Maricopa, and facilities staff there built an improved cart to help us move it around the campus.  The STEM grant provided funding for several important items for our programs, including new "Sunspotter" telescopes, one for SPC and one for SMC, a 14-inch telescope for SPC, a digital camera for astronomy for SPC, and 2 smaller telescopes for Maricopa. We intend to obtain an additional telescope for SMC with STEM funds this year.  One funding shortfall has been in providing resources for the SPC observatory, which could benefit from upgrades to the existing computer control system for the large (24-inch) telescope. The computers used now for that system are more than 12 years old. |
| Discuss the adequacy of the human resources available to the program over the past 5 years:  Geology and astronomy instruction has been provided by 1 full-time and 2 adjunct instructors. As enrollment grows, the college would benefit from additional full-time hires in this area. There is concern that changes in the teaching qualification rules from the Higher Learning Commission may disqualify some college instructors, particularly adjuncts. |
| Discuss the adequacy of the technological resources available to the program over the past 5 years:  There has been a marked improvement in internet capabilities in recent years around the campus. It is now feasible in many cases to stream video directly from the web to students, something that would not have been possible 2 or 3 years ago. Google Earth, a powerful tool for both geology and astronomy, now works on classroom laptops with classroom wi-fi: again, something that was not possible a few years ago.  Instruction at the SPC observatory would benefit from addition of wi-fi to that building, as well as replacement of the aging computers. |
| Discuss the adequacy of the physical (building space, classrooms, labs, etc.) resources available to the program over the past 5 years:  The new classrooms at SMC, San Tan, and Maricopa have provided a nice environment for our courses. A lingering concern at Maricopa is the rather loud air handling system in the geology classroom C-106, which at times makes it difficult to talk to students (or hear them). The SPC geology classroom would benefit from running water. The SMC geology classroom needs electrical outlets at all student tables. |
| Discuss the adequacy of the academic support resources available to the program and its students over the past 5 years:  Tutoring support has been good, but our students could always benefit from more tutors available for longer hours, if the tutoring budgets were able to provide this. |
| Discuss the adequacy of the student support resources available to the program and its students over the past 5 years:  Due to our temporary STEM grant, our student support resources have been excellent for those of our students who encounter them (especially our STEM advisor position).  We have also provided degree tip sheets, science book loans, calculator and iPad loans, for those students participating in our temporary STEM grant program. |

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| **Program Effectiveness** |
| Describe how you measure the success of degree and certificate program graduates in achieving the degree and/or certificate program student learning outcomes. What data have you collected that indicates the level of student success of these outcomes? According to the data, how well have students achieved these outcomes during the past 5 years?  Our program is too new to have significant data in this area. The one student who has completed the program to date has transferred to an Arizona University. |
| If you have data which indicates the degree to which students in the program are achieving the college’s Common Student Learning Outcomes please share and explain the data.  N/A |
| How many program enrollees or graduates studied at an in-state baccalaureate level institution during the past 5 years? Put the data in the table below.  We believe the answer is one, now enrolled for 2015-2016, based on personal communications from the student.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Degree/Certificate | 2014-15 | 2013-14 | 2012-13 | 2011-12 | 2010-11 | | Geology and Planetary Science | 0 | 0 | 0 | N/A | N/A | |  |  |  |  |  |  | |
| If a degree is intended for transfer, or has transfer articulation agreements in place, indicate how the degree program supports students with continuing their education at CAC or other institutions.  [See above] Our program helps Central students stay on track to complete both their A.S. degree and to complete their bachelor’s degree program with minimum time and tuition needed. |
| Describe the level of success (via completion rates, GPA, etc.) the program’s prior students have achieved at transfer institutions.  N/A – Newly completed A.S. students have not yet had time to complete any transfer program. |
| If a degree or certificate is designed to lead directly into the workforce, describe the success of students in obtaining a job in the field of study upon graduation. Please provide any qualitative or quantitative data you have:  N/A – This is not the degree’s designed purpose. Anecdotally, one or two of our students have indicated that they have jobs in the mining industry. |
| If your program serves to prepare a student for external certification or licensure of any kind identify the certification or license and the percentage of program graduates who earn/achieve it. Put data in the table below.  \* This table is not applicable (N/A) for this program   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Licensure/Certification | 2014-15 | 2013-14 | 2012-13 | 2011-12 | 2010-11 | | \* | N/A | N/A | N/A | N/A | N/A | |  |  |  |  |  |  | |

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| **Program Continuous Quality Improvement** |
| Discuss how the program has used learning outcome assessment results to improve instruction and/or student learning over the past 5 years:  We are still working to establish baseline data in this area. |
| Discuss how the program has used operational planning goals to achieve quality improvement over the past 5 years:  We have been modifying our geology and astronomy lab procedures to include more critical thinking projects than previously existed. |
| Describe other ways the program has engaged in continuous quality improvement:  We have recently increased the online component of our astronomy classes, making use of improvements in video-streaming technologies to eliminate some passive laboratories. Students can watch certain materials at home, and attend class fewer hours. They will still attend class for lectures, and for our more active laboratories, involving telescopes, spectrometers, computers, binoculars, and cameras.  ASU has made available online modules for courses such as planetary science as part of the “Inspark” Network that we will be investigating for future use. |

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| **Program Alignment with Institutional Goals:**  *Describe how the program has directly or indirectly is helping the College achieve its current strategic goals.* |
| The A.S. in Geology and Planetary Science Degree program directly or indirectly supports each of the following College Goals:  Ensure broad access to high-quality innovative educational programs, services and training opportunities for Pinal County residents  Improve student retention, persistence, completion and job placement  Ensure a safe, sustainable environment that promotes learning, communication, diversity and satisfaction among students, faculty and staff  Enhance our physical and technological infrastructure to support changes in the learning and work environment  Expand partnerships with Universities to provide advanced degrees to Pinal County residents  Optimize fiscal resources that support the needs and expectations of students and the community  Contribute to the economic vitality, workforce development, and job training needs of Pinal County and surrounding region. Pinal County has substantial mining activity and some of our students are or have been employed in the mining industry. Our geology program in Superior in particular is tied to the local mining industry. |