RECORD OF ACADEMIC ACHIEVEMENT

The Evergreen State College - Olympia, Washington 98505

OFFICIAL TRANSCRIPT DOCUMENT

Kleiva, Mackenzie Suzanne — A00268516

Last, First Middle — Student ID

DEGREES CONFERRED:

Bachelor of Arts and Bachelor of Science Awarded 14 Jun 2019

TRANSFER CREDIT:

Start	End	Credits	Title
04/2010	12/2013	90	**Olympic College**

EVERGREEN UNDERGRADUATE CREDIT:

Start	End	Credits	Title
09/2016	03/2017	32	**Mathematics in Geology** *6 - Physical Geology with Laboratory* *6 - Environmental Geology with Laboratory* *8 - Precalculus I and II* *4 - Statistics and Quantitative Reasoning in Geology* *2 - Seminar and Library Research* *6 - Guided Undergraduate Research in Earth Science*
04/2017	06/2017	16	**Astronomy and Cosmologies** *5 - Introductory Astronomy, with Labs and Field Studies* *3 - Introductory Algebra-based Physics, with Labs and Workshops* *3 - Writing, Literature, and Communications: Essay and Narrative Forms in the Sciences* *3 - Cosmology: Scientific and Cultural Studies of the Universe, and Our Place in the Universe* *2 - Research Project: Life on Mars and Magnetism*
09/2017	06/2018	44	**Integrated Natural Science** *7 - General Biology: Evolution and Ecology* *9 - General Biology: Cell and Molecular with Laboratory* *3 - General Biology: Physiology* *14 - General Chemistry I, II and III with Laboratory* *4 - Historical Geology* *4 - Fundamentals of Soil Science* *3 - Science Communication*
09/2018	06/2019	48	**Environmental Analysis** **12 - Analytical Chemistry with Laboratory* **6 - Aqueous Geochemistry with Laboratory* **5 - Aqueous Geochemistry Project* **4 - Biogeochemistry* **2 - Geographic Information Systems (GIS)* **3 - Technical Writing Project: NSF-style Proposal* **4 - Analytical Geochemistry* **12 - Independent Research Project in Analytical Geochemistry*

Cumulative

230 Total Undergraduate Credits Earned

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Having always thrived in interdisciplinary learning communities, The Evergreen State College seemed like the natural choice when I returned to the college pathway in 2016. I had taken a break from school to find myself and my passions, and to find out what really inspires me. I considered the 'Big Questions' obsessively. On a quest for truth, I explored art, nature, community, and solitude. Along the way, I was constantly reminded of my dream to become a teacher, but did not understand in what way I could satisfy both my curiosity and my desire to shed light on truth for others. Evergreen has brought me clarity in this matter. My AA was spent building a solid liberal arts foundation with a focus on communication, but through Evergreen I have discovered my passion for science and for sharing the joy of understanding scientific concepts with others.

While in the Math in Geology program, I realized that, despite my aptitude and capacity to learn and adapt quickly, I had been afraid to pursue science as a woman. I developed a working growth mindset in my first quarter, and grew significantly on a personal and academic level. I worked on collaborative research about radiometric dating and mercury cycling, and actively participated in a very strong learning community. Through the remainder of the program in the winter quarter, I pushed myself further. I participated in extra research so as to learn how to use the mercury analyzer. I solidified my understanding of pre-calculus concepts, and developed a strong background in physical geology and soil processes. This program opened me up in many ways, and allowed me to reach a level of comfort within the sciences which I had never known before.

My next program, Astronomy and Cosmologies, gave me a whole new perspective on science and storytelling. I developed deep insights into the greater story from which not only all scientific exploration, but the human experience, emerges. Exchanging ideas and sharing knowledge through seminars, peer review sessions, and a group project allowed me to strengthen my communication and facilitation abilities.

During this quarter, I also spent a significant amount of time preparing for a summer undergraduate research fellowship (SURF), including receiving Evergreen certification to operate the inductively coupled plasma mass spectrometer (ICP-MS) in order to get accepted for this competitive opportunity studying phosphorus cycling in Mt. St. Helens forest soils. Through this research, I began learning chemistry, lab techniques, instrumentation, trouble-shooting, and an incredible amount of patience for myself. I presented to the Evergreen Foundation, which makes funding for the SURF possible, and participated in a poster session, for which my research partner and I presented our findings and made recommendations for future work. Following this project, I realized that I needed to develop my background in science further.

During Integrated Natural Sciences, I was able to build a solid foundation and improve my abilities to support my learning community while filling the position of teacher's assistant for the geology and soil science components of the class. The program combined historical geology, soil science, general chemistry, and general biology, which allowed for each discipline to be learned within the context of the others. My ability to interact with lectures, workshops, and labs from different angles bore a strong understanding of the fundamentals of natural sciences, from which I pulled from greatly as I continued on into my final year at Evergreen.

Environmental Analysis was a program which allowed me to tie all of the pieces of my previous studies together. I used my previous interest in phosphorus to study the distribution of this limiting nutrient in meromictic lakes, learning analytical techniques and more instrumentation. I also developed the skills necessary to design and execute projects from fieldwork to final paper by researching the role of salmon as transporters of mercury from marine to stream ecosystems, my capstone project. Environmental Analysis allowed me a great deal of freedom, but this came with an incredible amount of responsibility to create and meet deadlines, troubleshoot problems, and network with local organizations and citizens.

Throughout my Evergreen experience, I gained invaluable insights into how to work well independently and as a part of a community, manage my time as a full-time student while working, and appreciate my strengths in forging connections between concepts. While many of the 'Big Questions' still remain unanswered, I have built myself a toolkit for exploring concepts in global environmental change and sharing these techniques with others.

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September 2018 - June 2019: Environmental Analysis

48 Credits

DESCRIPTION:
Faculty: Abir Biswas, Ph.D. and Robin Bond, Ph.D.

Environmental Analysis was designed as a full-year interdisciplinary program that combined material in Analytical Chemistry, Aqueous Geochemistry, Biogeochemistry, GIS, Geochemical Analysis, and interdisciplinary projects. In fall, the thematic focus was an analysis of lake water and sediments. Students' learning in the classroom was supplemented through a week-long field trip to eastern Washington to study meromictic lakes in that region, in addition to the regional geology and recent glacial deposits. At the lakes, students worked in groups to collect lake waters at different depths (from a boat using a van Dorn sampler), characterize lake water quality (e.g., temperature, conductivity, dissolved oxygen, pH, turbidity), and had opportunities to participate in lake sediment coring. In winter, program content was unified by a technical research and writing project that combined study design, field sampling and instrumental techniques (that students had the option to undertake in the spring quarter). Over each quarter, students had the option to analyze the collected waters and sediments in laboratory settings. In spring, students learned additional techniques in analytical geochemistry and had the option to perform the independent research project designed in winter quarter.

Analytical Chemistry with Laboratory –The textbook *Quantitative Chemical Analysis*, 8th ed., by Daniel C. Harris was covered fully with emphasis placed on techniques applicable to aquatic and environmental systems. Topics covered were chemistry of analytical methods, including chemical activity, chemical equilibrium, titrations, solubility, acids/bases, and chelation chemistry. Electrochemistry was also covered with applications to using and developing electrochemical probes. Principles of quality assurance and control were covered in the classroom and also applied in the context of learning major instrumentation. Fundamental theory and applications of separations and instrumental analysis were also covered. Students' content knowledge was assessed via two exams in each quarter. The laboratory portion included experiments involving alkalinity by acid/base titrations, analysis of total dissolved solids, gravimetric and potentiometric analysis of chloride, colorimetric analysis of silica, EDTA and redox titrations, and UV-Vis analysis of indicators. Special attention was given to processing samples for trace metal analysis and identifying and removing interferences. Throughout the program, emphasis was placed on reading and following standard analysis procedures published by the EPA, USGS, and APHA. Students maintained laboratory notebooks detailing their work in the laboratory and submitted analyses of their data. Students had the option to become certified for theory and operation of analytical instrumentation such as anion analysis by ion chromatography (IC) and cation analysis by Inductively-Coupled Mass Spectrometry (ICP-MS).

Aqueous Geochemistry with Laboratory – Topics covered in the program progressed from equilibrium thermodynamics and activity, to the carbonate system, soils and chemical weathering, to the hydrologic cycle and evaporating systems, and finally redox equilibria and redox in natural waters. In geochemistry lab, students made hands-on measurements of alkalinity in naturals waters (using Gran-Alk plots), characterized lake water cycling and the development of meromixis (prior to going to the field), characterized lake cores for moisture and organic carbon content, and used the aqueous geochemistry modelling program PHREEQC (from the USGS) to characterize the speciation and saturation indices of the lake waters they visited (based on real measurements of cations and anions by ICP-MS and IC respectively). Students demonstrated their learning through weekly homework assignments and three written exams that covered material from lecture and seminar, in addition to lab and field notebooks recording their observations and interpretations. Observations of individual and group work in labs and in the field were also useful in evaluation. The program used *The Geochemistry of Natural Waters: Surface and Groundwater Environments*, 3th ed., textbook by Drever and was supplemented by some readings from the primary literature.

Biogeochemistry – Concepts in biogeochemistry were taught using the text *Biogeochemistry: An Analysis of Global Change* (3rd ed., by Schlesinger and Bernhardt) through lectures, workshops, and discussions. This was supported by seminars and workshops discussing recent articles from the primary literature. Topics covered included: terrestrial geochemistry and the origin of the elements; rock weathering and nutrient availability; soil and ecosystem development including organic matter accumulation, soil cation exchange capacity, and changes in nutrient sources; biogeochemical processes in the atmosphere; and natural and anthropogenic controls on climate in the past and into the future. Students demonstrated their knowledge of this material through 3 in-class examinations, in addition to regular homework assignments.

Geographic Information Systems (GIS) – Students learned the fundamentals of working in ESRI ArcMap 10.6 and ESRI ArcGIS Pro 2.3. In ArcMap 10.6, student became familiar with downloading and importing DEMs, queries, symbology, and creating new shape and raster files. An emphasis was placed on using the Spatial Analyst and Hydrology tools, as students performed drainage basin analysis. Students were introduced to ArcGIS Pro 2.3, by completing the ESRI "Getting Started with ArcGIS Pro" module (5.5 hrs). Over the quarter, students completed 3-5 additional hours of ESRI modules (typically using ArcGIS Pro 2.3), and had the alternative option of developing a figure in support of their winter research project (in place of some modules).

Aqueous Geochemistry Project – The study of meromictic lakes (lakes that do not mix completely) in eastern Washington integrated understanding maps, rocks, floods, glaciation, chemical reactions and equilibria. Groups took field measurements of lakes (pH, dissolved oxygen temperature and conductivity). Lake water samples were analyzed in the laboratory for major chemical species - chloride, sulfate, sodium, potassium, calcium, magnesium, and alkalinity. Each group was responsible for producing complete major-element chemistry for 2 lakes at 3 to 4 depths using a variety of analytical techniques. Individuals in research groups worked together to write group Introduction and Methods sections, describing their own research question based on the samples they collected. Students read literature from USGS reports and geochemical literature to expand their understanding of the origin of meromixis and rock-water interactions. Application of analytical chemistry, communication skills, report writing, and sharing information were a fundamental part of the field-lab study.

Technical Writing Project: NSF-style Proposal –In preparation for spring quarter research projects, students designed NSF-style proposals, including an introduction, methods, a sampling plan, in addition to providing an explanation of the scientific merit of their project. These proposals employed field and lab techniques students learned during the program and were based on a foundation of at least 10 studies from the primary literature. Students sought to collect seed-data (eg. provide a proof of concept) including collection of samples analogous to their proposal (examples in the program included sediment, fish, bivalves, and lake water) and analysis using instrumental techniques learned in the program (examples in the program included IC, ICP-MS, Nippon MA-3000 mercury analyzer, UV-VIS, and alkalinity titrations). Students summarized their proposals in poster-format that were presented to the class.

Analytical Geochemistry— Students acquired knowledge of analytical techniques common in geochemical analysis. Methods such as XRD and XRF were taught in conjunction with the theory of mineral structures and solid solution, laying the foundation for mineralogical analysis. A deeper understanding of MS-MS was taught together with nuclear chemistry and radioisotope dating methods.

Independent Research Project— Building on the NSF-style technical writing project from winter, students did additional literature review and wrote a detailed standard operating procedure (SOP) for sample collection, processing, and analysis. Students employed field and lab techniques learned during the program to collect data on their chosen topic. Students learned skills for successful oral presentations in front of both scientific and general audiences. Students presented results at the Evergreen Science

Carnival (a yearly outreach event) in poster or oral presentation format and also wrote a scientific paper presenting their results. Details of individual projects are given in evaluations below.

EVALUATION:
Written by: Abir Biswas, Ph.D. and Robin Bond, Ph.D.

Mackenzie enrolled in Environmental Analysis as preparation for a career in environmental sciences. Mackenzie was very successful in meeting this goal, producing work that was very good to outstanding throughout the year. Mackenzie was a reliable team member when group work was necessary and was also strong at solo work, as showcased by a successful independent research project that attempted to link salmon carcasses to mercury deposition in an ecosystem. Overall, Mackenzie shows strong abilities at working with both theory and laboratory projects.

Analytical Chemistry with Laboratory - Mackenzie's understanding and problem-solving ability in the analytical chemistry portion of the program was very good to excellent. During group work, Mackenzie engaged well with other students to learn material. Mackenzie completed the majority of the homework with a very good level of understanding. Mackenzie was highly involved in discussions on chemical literature and demonstrated excellent comprehension of the papers studied. Mackenzie's performance on the fall midterm covering systematic treatment of equilibrium and statistical data analysis showed very good mastery of these topics. Mackenzie also showed very good understanding on the final exam in fall, which covered topics such as acid-base equilibrium, electrochemistry, electrodes, and concepts of instrumental analysis. In winter, Mackenzie's performance on the midterm demonstrated outstanding mastery of concepts such as complexation equilibria and both absorption and emission spectroscopy. On the winter final, Mackenzie demonstrated excellent comprehension of mass spectrometry and separations. Mackenzie was a highly engaged participant in chemistry laboratory and generally demonstrated very good bench skills. Mackenzie's lab notebook was complete and thorough. Mackenzie's lab reports were exhibited a strong ability for statistical analysis and data interpretation. Mackenzie successfully completed training to become an operator of both the IC and the ICP-MS to perform analytical studies and independent research. The science instructional technician for the IC found Mackenzie's operation of the instrument to be smooth and without issues. The instrument aide for the ICP-MS wrote that Mackenzie "showed impressive understanding of all theory and operation of the instrument."

Aqueous Geochemistry with Laboratory – Mackenzie was a consistent and very hard-working student in the aqueous geochemistry component. She demonstrated very strong engagement with the program material week-to-week through very detailed notes of assigned readings before class, and over the quarter she demonstrated an outstanding understanding of the program content. Mackenzie had excellent attendance, and she submitted 6 of 7 homework assignments on time and they were very well done. During group work, Mackenzie worked exceptionally well with fellow students to discuss and understand the material. Through an in-class examination including topics of equilibrium thermodynamics, carbonate chemistry, and soils, which included a significant component of quantitative work, Mackenzie demonstrated an outstanding understanding of the material. On an in-class examination including topics of evaporation, precipitation, and chemical weathering processes, Mackenzie again demonstrated an outstanding understanding of the material. Mackenzie worked hard over the quarter and on a final in-class examination she again demonstrated an outstanding understanding of topics related to saline lakes, redox equilibria, and redox processes in natural waters. Mackenzie's lab notebook was well-organized and included excellent details of procedures associated with lake sediment characterization for % carbon and moisture. Mackenzie participated in leaching sediments (following a modified EPA method 3050b) to investigate major elements, and demonstrated an understanding of the PHREEQC (USGS) program that would provide context into possible precipitates from saline waters.

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Biogeochemistry– In the winter, Mackenzie was an outstanding student in the biogeochemistry component of the program. She had excellent attendance, and was very well engaged, submitting 7 of 7 homework assignments on time that were very well done. Through an in-class examination covering topics including the geochemistry and cycling of geologically-derived elements, Mackenzie demonstrated an excellent to outstanding understanding of the material. Then, on an in-class examination including topics of soil development and nutrient cycling in soils, Mackenzie demonstrated an outstanding understanding of the material. Mackenzie worked very hard through the quarter, and on a final in-class examination, again demonstrated an excellent to outstanding understanding of topics related to the effects of anthropogenic activities on the atmosphere and terrestrial ecosystems. It is notable that over the quarter, Mackenzie consistently demonstrated an excellent ability to understand and explain both quantitative and qualitative problems related to biogeochemical processes.

Geographic Information Systems (GIS) – Mackenzie entered the program without past experience in GIS, and was very diligent in developing this new skill. Mackenzie completed lab activities using ESRI ArcMap 10.6 (developing basic skills in downloading data, working with shape and raster files, and using Spatial Analyst tools) in an exemplary manner. In addition she engaged in independent learning of ESRI ArcGIS Pro through ESRI modules including “Getting Started with ArcGIS Pro” (5.5hours) and additional hours working with climate data in ArcGIS Pro. Mackenzie applied her knowledge by independently designing and producing an informative and well-designed map of salmon spawning regions near Hoodsport, WA in support of the writing/research project she conducted during winter quarter. This work has given Mackenzie a good foundation in both ESRI ArcMap 10.6 and ESRI ArcGIS Pro, that she can build on if she chooses.

Aqueous Geochemistry Project - Mackenzie was a very strong contributor to a successful group of 4 students who conducted a study entitled “An inquiry into accumulation and distribution of limiting nutrients in Eastern Washington meromictic lakes”. Mackenzie read and wrote excellent annotations for 4 articles as they developed a background in this topic. Mackenzie and the group worked very well together, dividing most tasks, and the group Introduction and Methods components of their group project were both very well done. Mackenzie played a major role in organizing their group, and was a particular leader in reading articles to connect redox state with phosphate and nitrate availability in lake profiles. Mackenzie then took the lead in developing these slides for their Powerpoint presentation. During their final presentation, Mackenzie was very comfortable, demonstrating an enthusiastic, well-metered speaking style and interacting dynamically with the audience. Mackenzie worked hard on sample analysis and she finished up her Lakes research with a final paper entitled "An inquriy into controls over the accumulation and distribution of phosphate in Eastern Washington meromictic lakes". The document was very well-written and well-researched, and she demonstrated a strong interpretation of her data.

Technical Writing Project: NSF-style Proposal– In preparation for a spring quarter research project, Mackenzie wrote an excellent NSF-style proposal entitled “Mercury in salmon: Effects of chum carcass enrichment on a stream ecosystem”. Her proposal was very well designed to quantify the addition of the toxic trace metal mercury to stream ecosystems-- as measured in stream periphyton as a salmon-carcass-impacted site, and a salmon-free site (above a dam on the same river). Mackenzie was trained on the mercury analyzer (Nippon MA-3000), which she intended to use to analyze samples for her proposed project. Mackenzie successfully operated the mercury analyzer independently to analyze salmon samples to produce seed-data, demonstrating that she was well-prepared for independent spring quarter lab work. Mackenzie’s final document, which was improved through the review process, was excellent and included terrific information and justification for the proposed work. In support of this project, she read and wrote detailed annotations for 10 peer-reviewed articles, providing a strong foundation for her proposed work. Mackenzie was very professional in presenting her proposal in the form of an informative and well-organized poster to her colleagues in the program, and she did a great job of explaining our current understanding of mercury salmon as well as mercury transport and cycling in stream ecosystems.

Analytical Geochemistry—Mackenzie was a highly engaged participant in the analytical geochemistry portion of the program, with excellent work overall. Mackenzie submitted all 6 homework sets, which were generally very good in quality. On the midterm exam, which covered Pauling rules, mineral structures, solid solutions, and use of XRD and XRF for mineral analysis, Mackenzie's performance was outstanding. On the final exam, which covered nuclear chemistry as well as normal and cosmogenic radioisotope dating, Mackenzie's performance was excellent.

Independent Research Project in Analytical Geochemistry— Mackenzie's research project, entitled "Mercury in Salmon: Effects of Chum Carcass Enrichment on a Stream Ecosystem" involved evaluating mercury concentrations in both chum salmon caught in the Hood Canal region and periphyton from a stream in the same area. As part of this project, Mackenzie read, and incorporated into a final paper, an additional twelve peer-reviewed articles (in addition to those read in winter). Mackenzie wrote a detailed standard operating procedure that contained sections such as periphyton collection, sample filtration, and mercury analysis (among others). In lab, Mackenzie demonstrated very good analytical technique and produced a lab notebook that was neat and thorough. Mackenzie presented an oral presentation at Science Carnival which not only presented methods and results of the study but also included a hands-on demonstration of bioaccumulation. Mackenzie's final paper was well-written and showed good thought regarding the fate of mercury in streams, but could have benefited from additional statistical analysis. In general, Mackenzie's project showed very good aptitude for scientific laboratory work and data analysis.

SUGGESTED COURSE EQUIVALENCIES (in quarter hours) TOTAL: 48

*12 - Analytical Chemistry with Laboratory
*6 - Aqueous Geochemistry with Laboratory
*5 - Aqueous Geochemistry Project
*4 - Biogeochemistry
*2 - Geographic Information Systems (GIS)
*3 - Technical Writing Project: NSF-style Proposal
*4 - Analytical Geochemistry
*12 - Independent Research Project in Analytical Geochemistry

* indicates upper-division science credit

Kleiva, Mackenzie Suzanne — A00268516
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September 2017 - June 2018: Integrated Natural Science

44 Credits

DESCRIPTION:
Faculty: Abir Biswas, Ph.D., Clarissa Dirks, Ph.D., Robin Forbes-Lorman, Ph.D., Mike Paros, D.V.M., and Paula Schofield, Ph.D.

Integrated Natural Science is a full year interdisciplinary science program that includes general biology, general chemistry, historical geology, and soil science. The following description is for fall, winter and spring quarters, and although each subject is listed separately, the material was delivered in an integrated manner, approaching many concepts from biological, historical, and chemical perspectives. Each week, students spent 13 hours in lecture and small group problem solving sessions, and 6 hours in laboratory. Students were assessed through completion of homework assignments, quality of laboratory notebooks, and performance on several quizzes and examinations.

General Biology: Evolution and Ecology with Laboratory: The textbook for all biology was *Biological Science*, 6th ed., by Freeman et al. Students also read several primary literature papers to learn the many topics covered. In this area we began with the focus of life by analyzing patterns of natural selection and inheritance. Concepts in Mendelian Genetics and the chromosomal basis of heredity were explored using a problem based approach. Evolutionary processes were covered by studying how allele frequencies can change in populations. The history of life included a more in-depth study of bacteria, archaea, fungi, protists, plants, and animals. Students also engaged in learning about viruses, viral evolution and the immune system. Students applied their knowledge of the diversity of life to the study of ecology at multiple scales: behavioral, community, population, and ecosystems. Laboratory investigations included plant dissections, identifying and classifying unknown organisms, meiofaunal research surveys, and field methods. On a 4-day field trip to Eastern Washington, students conducted ecological field research in small groups. They made field observations, designed natural experiments, collected substantive data sets, and employed appropriate statistical analysis when possible. After data analysis they created a one page vignette of their work.

General Biology: Cell and Molecular with Laboratory: Students learned about the characteristics of living organisms and the changes that occurred in the cell across evolutionary time, including the plasma membrane, bacteria and archaea structure and function, eukaryote structure and function, and multicellularity. Labs included aseptic technique, bacterial growth and quantification, bacterial identification, microscopy, and subcellular fractionation. In winter quarter, students learned core concepts in cellular biology, molecular biology, and biochemistry. Specific topics included nucleic acid structure and function, protein structure and function, gene expression and regulation, cell membrane transport and signaling, cell division and the molecular basis of cancer, cell respiration and metabolism, and photosynthesis labs focused on molecular biology techniques, including PCR, gel electrophoresis, cloning, and signal transduction in yeast.

General Biology: Physiology with Laboratory: This part of the program focused on mechanisms that organisms use to address some common issues of survival and maintain homeostasis. Specific topics included coordination and control via the nervous and endocrine systems, neural signaling, sensory biology, water and electrolyte balance, and gas exchange and transport. Labs included gross and microscopic anatomy, cardiovascular physiology, and urinary physiology.

General Chemistry I, II & III with Laboratory: The textbook was *Chemistry: The Central Science*, 13th ed., by Brown, Le May and Bursten. Topics covered in fall and winter included measurement, nomenclature of inorganic compounds, stoichiometry, aqueous reactions, ionic equations, periodic properties of the elements, electron configuration, Lewis structures, chemical bonding, molecular shape,

and intermolecular forces. More detailed topics covered included thermochemistry, chemical kinetics, and general chemical equilibri. Aspects of chemistry as they relate to biological systems were emphasized, such as biological redox reactions, enzyme kinetics, and the thermodynamics of biochemical reactions. In spring quarter, students applied their knowledge to more complex concepts in bonding (hybrid orbital and molecular orbital models), aqueous equilibria: acid-base, buffers, and solubility product, electrochemistry and gas laws. In lab, students were introduced to the basic techniques of lab and field science. Laboratory exercises and techniques included UV and visible spectroscopy to determine the concentration of unknowns via standard curve methods; titrations, including an EPA method to determine the hardness of water, and a back titration; gas chromatography and thin-layer chromatography; natural product isolation via steam distillation; determination of a partition coefficient; acid-base extractions; the determination of the activation of an enzymatic reaction; polyprotic acid titrations to determine pKa, IR spectroscopy, and column chromatography of plant pigments. Field measurements including dissolved oxygen, pH, temperature, flow rate, and conductivity were carried out at various sites along a creek and a lake.

Historical Geology: The textbook *Earth System History*, 4th ed., by Stanley and Luczaj was used to cover topics related to the evolution of life and the evolution of geochemical cycles through geologic time. Students started with the Big Bang and Hadean Eon and progressed through time into the Pleistocene Epoch, with coursework supplemented by one fossil-based laboratory activity as well as abstracts and figures from primary literature. Some students elected not to take this fall quarter-only component of the program.

Fundamentals of Soil Science: The textbook *Elements of the Nature and Properties of Soils*, 3rd ed., by Brady and Weil was used to cover topics related to soil development and classification, the soil food web, and carbon, nitrogen, and phosphorus cycling in soils. Readings were supplemented with abstracts and figures from primary literature. Students characterized and collected soils from a local forest, and laboratory activities were focused on quantifying % water, % organic matter, and grain size distribution of these soils. Some students elected not to take this winter quarter-only component of the program.

Science Communication: In fall quarter, students completed a weekly synthesis assignment, in which they responded to weekly learning outcomes related to the material, made connections within the different content areas of the program, and reflected on their learning. For every assignment, students also completed anonymous peer reviews of two other students' syntheses. In spring quarter, students carried out an integrative group research project on an organism of their choice, culminating in a poster presentation. They used primary literature and other sources to study the physiology, evolution and ecology, and biochemistry of their organism.

EVALUATION:
Written by: Abir Biswas, Ph.D., Clarissa Dirks, Ph.D., Robin Forbes-Lorman, Ph.D., Mike Paros, D.V.M., and Paula Schofield, Ph.D.

Mackenzie entered this program to gain an understanding of the fundamentals of science and its application. Throughout the year, Mackenzie developed a solid foundation in the sciences, learning not only important topics in biology, chemistry, geology and soil science, but also gaining quantitative, laboratory, writing, and communication skills that are essential to becoming a literate scientist.

Based on weekly exams, Mackenzie showed very good comprehension of the major biology concepts covered in the evolution portion of the program. Mackenzie completed all of the assigned reading and study questions throughout the quarter, demonstrating thorough preparation prior to lectures and workshops. In the spring, Mackenzie demonstrated an overall very good comprehension of the concepts and skills presented as evidenced by work in and out of class. Mackenzie's performance on in-class exams indicated a very good understanding of topics including the diversity of life, virology, immunology,

and different levels of ecology. Mackenzie showed fairly good engagement and turned in 8 of 12 homework assignments.

In the cell biology component of the program in the fall, Mackenzie demonstrated an excellent understanding of the material. In addition, Mackenzie took advantage of the opportunity to engage in the material through assignments, completing all nine assignments. Mackenzie did very good work in lab: Mackenzie came prepared with four of the five pre-labs completed. Mackenzie's lab notebook and lab analyses were very good. In winter quarter, Mackenzie demonstrated an overall very good understanding of cell biology based on weekly quiz scores. Mackenzie completed all of the homework reading assignments. Mackenzie demonstrated a very good understanding of molecular biology. In addition, Mackenzie took advantage of the opportunity to engage in the material through assignments, completing eight of the nine assignments. Mackenzie did very good work in molecular biology lab. She came very well prepared for lab, earning an average of 96% on pre-lab quizzes. Mackenzie completed all three lab analyses and these were very good. Her lab notebook was adequate.

In the physiology component, Mackenzie demonstrated a very good understanding. In addition, Mackenzie took advantage of the opportunity to engage in the material through assignments, completing six of the seven assignments.

In the yearlong study of general chemistry, Mackenzie worked hard to gain a foundation in chemistry and apply this knowledge to other sciences. She attended all class activities and completed all homework assignments. Overall, Mackenzie demonstrated an excellent understanding of the fundamentals of general chemistry, such as chemical equations, Lewis structures, chemical bonding, and stoichiometry. In addition, she showed a very good to excellent grasp of more complex and quantitative topics such as chemical kinetics, equilibria, and thermodynamics. Mackenzie worked well both individually and in small groups to apply her knowledge to solve problems. In lab, Mackenzie carried out her experiments in a safe and professional manner and learned the basic laboratory bench skills and techniques in general chemistry. Mackenzie's chemistry lab notebook was a mostly excellent piece of work. It was detailed and organized, containing clear methods, data presentation, and analysis.

In the historical geology component of the program, Mackenzie was exceptionally well-engaged and demonstrated an outstanding understanding of the program content through in-class examinations. She had excellent attendance of the lectures and workshops and completed nine of nine homework assignments with excellent quality. Through in class examinations, Mackenzie demonstrated an excellent understanding of the evolution of life and geochemical systems in the Hadean through late Paleozoic, and she demonstrated an outstanding understanding of topics related to events through the Mesozoic Era. Mackenzie worked very hard over the quarter, and on a final examination, again demonstrated an outstanding understanding of events and climate through the Pleistocene Epoch.

In the soil science component of the program, Mackenzie was very well-engaged and demonstrated an overall outstanding understanding of the program content through in-class examinations. She had excellent attendance of the lectures and workshops, completed homework assignments on time and exceptionally well, and her lab notebook included a clear and sufficiently detailed record of her field and lab work. Through in-class examinations, Mackenzie demonstrated an outstanding understanding of topics related to soil formation and development and again demonstrated an outstanding understanding of topics related to soil classification, texture, and grain size distribution. Mackenzie worked hard over the quarter and again demonstrated outstanding understanding of material on a final in-class examination including carbon, nitrogen, and phosphorus cycles in soil. During the quarter, Mackenzie displayed tremendous initiative and effort in preparing for and leading weekly study sessions for students in the program, which undoubtedly supported the learning of her classmates.

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In the science communication component of the program in the fall, Mackenzie thoroughly completed all six weekly synthesis assignments, earning 99% of the possible points. Mackenzie completed all 12 peer reviews and gave her fellow students particularly thoughtful and valuable feedback. For the integrative group research project, Mackenzie's group showed excellent use of the literature and application of presentation skills to convey the physiology, evolution and ecology, and biochemistry of their organism.

SUGGESTED COURSE EQUIVALENCIES (in quarter hours) TOTAL: 44

7 - General Biology: Evolution and Ecology
9 - General Biology: Cell and Molecular with Laboratory
3 - General Biology: Physiology
14 - General Chemistry I, II and III with Laboratory
4 - Historical Geology
4 - Fundamentals of Soil Science
3 - Science Communication

Kleiva, Mackenzie Suzanne — A00268516
Last, First Middle — Student ID

April 2017 - June 2017: Astronomy and Cosmologies

16 Credits

DESCRIPTION:
Faculty: E.J. Zita (Ph.D. Physics), and Rebecca Chamberlain (M.A. English Literature)

Students learned beginning to intermediate astronomy through lectures, discussions, interactive workshops, and observations. Using naked eye observations, reason, and pre-calculus, they learned how the ancients measured the sizes, distances, and motions of the Earth, Moon and Sun. Students made tools to model heavenly motions, and to explore the nature of light and spectra. They experimented with lenses and optics, and built telescopes. They learned about the evolution, structure, and dynamics of the universe. They explored our galaxy, and neighboring galaxies, using binoculars, telescopes, and virtual planetarium programs. Students developed skills in algebra and basic trigonometry, studying physics from gravity and electromagnetism to dark matter and energy. Students explored research questions via observations, reading, and scientific methods. They created an annotated bibliography, proposal abstract, and shared their research presentations.

They read about, and discussed, cosmologies: how people across cultures and throughout history have understood, modeled, and ordered the universe they perceived. They studied stories, literature, and worldviews--from those of ancient peoples to modern writers, essayists, and astrophysicists. They also discussed current cosmologies in the context of environmental studies, studying climate change quantitatively and exploring modern myths as constructive narratives.

Students kept observation journals, told star stories, made star maps that explored the intersection between astronomy and art, and explored the art and craft of essay writing. They did substantial teamwork outside class, and wrote essays and responses to readings and field trips. Students were required to use the internet for information and online assignments, to work in teams, and to participate in star-hunts and field studies.

Our program hosted a major lecture series, “Science, Wisdom, and the Future: Humanities Quest for a Flourishing Earth,” featuring: 1) A screening of *Black Suns: An Astrophysics Adventure* and Skype session with Dr. Jarita Holbrook (Producer/Astrophysicist) and Kelvin Phillips, (Director/ Producer); 2) Lois Landgrebe, “Salish Star Stories in Lushootseed;” 3) Russ Genet (PhD. Astronomy), “Cultural Evolutionary Forces, Citizen Science, & a Flourishing Planet,” and Cheryl Genet (Ph.D. Philosophy), “Living Wisely in a Scientific and Technological Age; 4) Allen Mauney, “Special Relativity & the Connection to Science and Wisdom,” and Rebecca Chamberlain, “Interdisciplinary Approaches to Astronomy Education within Communities of Practice,” and “Sun, Moon, Earth: An Overview of the Solar Eclipse of 2017;” 5) Kathleen Ensenat, “One Way Trip: What are the Realities of Colonizing Mars, and What Does that Say About Earth?;” and 6) E.J. Zita, “Cosmology & Sustainability: People, Planet, Politics.”

Texts included: Timothy F. Slater and Roger A. Freedman, *Investigating Astronomy: A Conceptual View of the Universe*; Terence Dickerson, *Night Watch: A Practical Guide to Viewing the Universe;* Tyler Nordgren, *Sun, Moon, Earth: The History of Solar Eclipses from Omens of Doom to Einstein and Exoplanets;* Julius Staal, *The New Patterns in the Sky: Myths and Legends of the Stars;* Brian Swimme and Mary Evelyn Tucker, *Journey of the Universe;* and an anthology of essays and articles to supplement course themes.

Field trips included: Day of Absence, Day of Presence, an Indigenous Climate Justice Symposium, and presentations to South Sound High School.

Kleiva, Mackenzie Suzanne — A00268516
Last, First Middle — Student ID

EVALUATION:
Written by: E.J. Zita, PhD, physics

Mackenzie did great work and was a good citizen in Astronomy & Cosmologies. She attended reliably and participated actively. Mackenzie's independent critical thinking contributed to all areas of our program. She is smart and effective.

Mackenzie cares about our future, and about how to apply science and wisdom for a better future. She has unique skills – grasping both the big picture and the details, and integrating them appropriately. She makes connections – between astronomy and climate change, soil science and geology. Mackenzie is sure to make a difference.

Mackenzie is an intelligent and highly capable student, interested in action as well as theoretical understanding. She has a strong work ethic and great teamwork skills. Mackenzie shows very good understanding of scientific methods and skills in analysis and quantitative reasoning. It was a pleasure to have Mackenzie in our program, and we would be happy to work with her again.

Seminar: Mackenzie completed insightful Points, Insights, and questions every week, to prepare for our seminar discussions. Her comments and questions showed curiosity, strong reading comprehension, an open mind, and always critical thinking.

Workshops: Mackenzie engaged actively and wrote thoughtful reports on every single one of our workshops on astronomy, physics, and environmental studies. Mackenzie demonstrated strong skills in analysis, both qualitative and quantitative. She thinks like a scientist, and she cares about context and consequences.

Research: Mackenzie collaborated on a research/creative project, exploring the possibility of life on Mars (with teammates). A high point of Mackenzie's project was her experiment on the effect of magnetic fields on atmosphere evaporation (in the oven). Her presentation was clear and engaging.

Observing (Written by Rebecca Chamberlain): Mackenzie did excellent work with their astronomy observations and fieldwork, attending telescope training, star-hunts, and computer workshops. Through the use of binoculars, 8 and 12-inch telescopes, and Stellarium programs, they demonstrated the ability to identify major stars, constellations, visible planets, and deep sky objects from a spring observer's list. Mackenzie kept a regular fieldwork and observation journal that included detailed drawings, research, and information each week that demonstrated a good knowledge of celestial objects, and an excellent conceptual understanding of celestial motions. They also demonstrated an understanding of the relationship between art and astronomy by completing a star map of their cumulative observations in the form of a lantern that projected the constellations of the zodiac.

Writing and Communication (Written by Rebecca Chamberlain): Mackenzie demonstrated an excellent understanding of how to use various narrative forms to communicate ideas in the sciences and humanities. Through writing, oral presentations, and analysis of texts, they demonstrated fluency in using different communication mediums in different contexts (oral, written, and electronic). This included demonstrating proficiency through the performance of stories, knowledge of star-lore and comparative mythology, and analysis of traditions related to cultural cosmologies and the history of scientific thought.

Mackenzie is an excellent writer, complex thinker, and completed a major writing project (a mixed genre personal/expository essay) on the theme, "Science, Wisdom, and the Future: Humanities Quest for a Flourishing Earth." Their essay was well written, and their instructor said, "You explore personal and cosmic scales with a sense of wonder, exploration, adventure, stamina, and self-reflection." Throughout the quarter they met deadlines and were dedicated to incorporating feedback and critique, and they did an excellent job developing their editing skills and abilities by working effectively in editing groups and

developing their essay through four drafts. Mackenzie is a solid writer and is able to take risks to develop complex ideas. They should be proud of how their writing this quarter.

Mackenzie also wrote an explication, and told a star story, “Opossum and Pleiades,” a Barasana myth from Columbia. Their essay integrated scientific information, literary analysis, as well as rich cultural and historic information that explored seasonal cycles of fertility and regeneration. Finally, they wrote a persuasive academic essay, as well as essays about field trips that explored cultural diversity and equity in astronomy research and education, and that addressed questions of sustainability and justice. Mackenzie explored issues around becoming an effective ally and advocate by addressing complex social and environmental issues, saying, “we must continue to tell our stories, and to share our insights and opportunities with one another so that we can reach our collective and individual goals.”

Teamwork: Mackenzie wrote thoughtful peer evaluations, and classmates agreed that she was a great teammate. Three peers wrote:

> Mack Kleiva was reliable and communicative. She was motivated to perform the experiment for our research project and she contributed solid academic research to our project. She also provided space for us to meet to practice our presentation. Mack was positive and kept to our point so that we could always turn in assignments on time. I would definitely work with her again.
>
> Mackenzie was both in my seminar group and my research project group, Life on Mars. She engaged fully with the material, and worked hard to be ready to discuss seminar readings as well as have research and project material done for our group project. She started the process early in the term, and continued to hone her focus throughout. I felt like she was always responsible in being prepared on all levels.
>
> Mackenzie Kleiva attended reliably while being prepared for each discussion. She had great ideas, listened to all, and discussed as many aspects as possible. She continues to break the barriers and bias of understanding and perspectives of the people around her and her own self. I would work with her again if given the opportunity.

One teammate wrote at length:

> I found [Mackenzie] to be insightful, extremely intelligent both academically and socially, a critical thinker open to change in her own thought/perspective as well as questioning others’ conclusions. This allowed for more advanced sharing/learning than may have been possible otherwise. Because she is already trained in scientific enquiry and research, and I am on that path as well, I looked to her for advice and we were able to have a shared learning experience in relation to both the scientific research for our group project, Life on Mars, brainstorming on how to run her experiment and analyze it, as well as critical thinking related to specific class material and overall course dynamics.
>
> Mack really enhanced the group dynamic for me, reaching out to myself and other class members to initiate meetings, and added both an intellectual focus as well as a fun, social dynamic that I genuinely appreciate and view as an important team-building skill.
>
> I also found it rewarding to work in the editing process on Mackenzie’s Academic Statement. It is clear that over the last year she has really grown through the learning process at Evergreen, and even takes challenges or setbacks and turns them into a learning experience that helps guide her process. It was really cool to see her have “Aha!” moments.

Kleiva, Mackenzie Suzanne — A00268516
Last, First Middle — Student ID

[I would] definitely [like to work with her again, given the opportunity.]

SUGGESTED COURSE EQUIVALENCIES (in quarter hours) TOTAL: 16

5 - Introductory Astronomy, with Labs and Field Studies
3 - Introductory Algebra-based Physics, with Labs and Workshops
3 - Writing, Literature, and Communications: Essay and Narrative Forms in the Sciences
3 - Cosmology: Scientific and Cultural Studies of the Universe, and Our Place in the Universe
2 - Research Project: Life on Mars and Magnetism

Kleiva, Mackenzie Suzanne — A00268516
Last, First Middle — Student ID

September 2016 - March 2017: Mathematics in Geology

32 Credits

DESCRIPTION:
Faculty: Abir Biswas, Ph.D. and Rachel Hastings, Ph.D.

Math in Geology was a full-time coordinated studies program that brought together the studies of physical geology and environmental geology with precalculus mathematics and introductory statistics. The program was designed to help students gain experience with quantitative skills and earth sciences, and to prepare themselves for further studies in science and mathematics. Activities included lectures, problem-solving workshops, geology labs and field trips, and seminar discussions, in addition to a Fall quarter overnight fieldtrip to Mt. Rainier. Students participated in group research projects and presentations focused on radiometric dating in the Fall and on element cycling (calcium, phosphorus, or mercury) in the Winter.

The mathematics component covered standard precalculus topics with an emphasis on applications to geology. We covered Chapters 1-6 in *Precalculus: An Investigation of Functions* (Lippman and Rasmussen). This included the study of several families of functions: linear, polynomial, rational, exponential, and logarithmic, as well as 5 weeks on triangle and circle trigonometry. The class also worked through Chapters 1-7 in *Mathematics: A Simple Tool for Geologists* (Waltham), which covered a similar range of topics through the lens of modeling geological data and processes. One class session per week allowed students to choose between algebra review and extension problems in mathematical geology (covering a range of topics such as crystal structure and crustal density). In-class work included lectures and small-group problem-solving workshops twice a week. There were also two homework assignments per week (one on-line from our textbook, and another submitted on paper), and regular exams and quizzes (3 in Fall, 4 in Winter).

In Statistics, we worked from Waltham Chapter 7 in the last 4 weeks of Winter quarter. The material included introductions (in the context of geology) to the following topics: basic vocabulary, mean, variance, standard deviation, histograms, basic probability, normal distributions, regression, and standard error. In addition to performing hand calculations based on data from small samples, students also learned to use Excel spreadsheets to work with the above topics and to conduct T-tests and calculate p-values.

In the Physical Geology component of the program, students used the textbook *Understanding Earth*, 7^{th} ed. (Grotzinger and Jordan), to cover topics from the formation and evolution of Earth, to plate tectonics and igneous, sedimentary, and metamorphic processes, to major events through geologic time. In geology lab, students learned to characterize and identify common minerals and rocks, and participated in workshops focused on processing samples and analyzing mercury content in a range of samples. Students demonstrated their learning through weekly homework assignments, two laboratory practical exams, and three in-class exams that covered material from lecture and components from the laboratory. Observations of individual and group work in workshops and labs were also useful in evaluation.

In the Environmental Geology component of the program, students continued to use the textbook *Understanding Earth*, 7^{th} ed. (Grotzinger and Jordan), to cover topics focused on weathering, climate, and anthropogenic impacts on the environment, supplemented by readings from the primary literature focused on soil development and nutrient cycling. In the field, students characterized soil profiles and collected soils that were the basis for subsequent laboratory analyses. In the laboratory, students analyzed carbon content in soils and were introduced to bench-scale geochemical studies of the availability of nutrients in soils. Students also participated in 3 field trips focused on sedimentary

processes in different coastal settings. Students demonstrated their learning through weekly homework assignments, weekly notes summarizing readings, and three in-class exams that covered material from lecture and components from the laboratory. Observations of individual and group work in workshops and labs were also useful in evaluation.

In Fall and Winter quarters students participated in seminars focused on the social context of science education and research and also conducted library research-based guided undergraduate research projects. In Fall quarter, groups of 3-4 students were assigned one of four widely-used methods of radiometric dating which they studied via the literature. In Winter quarter, groups of 4-5 students were assigned an element (calcium, phosphorus, or mercury) and projects were based on literature research as well as data (for these elements) collected during the lab portion of the program. Both quarters, student groups conducted library research and worked together to find peer-reviewed articles in support of their project topic. Individually, students wrote annotated bibliographies (2 in the Fall, 4 in the Winter), summarizing their learning from each article. In the Fall, students wrote a short synthesis paper which presented their learning about the dating method, including a discussion of the exponential functions governing the relevant radioactive decay pathway, and a synthesis of several of the articles they had read. In the Winter, students wrote a short synthesis paper which presented their learning about the cycling of their element, particularly in the context of forest ecosystems and soils, synthesizing several of the articles they had read. At the end of each quarter, student groups prepared and delivered Powerpoint presentations in which they communicated their collective learning about their research project to the rest of the class.

EVALUATION:
Written by: Abir Biswas, Ph.D., and Rachel Hastings, Ph.D.

Mackenzie entered the Math in Geology program with a strong interest in environmental science and education. She was very successful in strengthening her quantitative background and building upon some past experience with geology. She was an excellent and engaged member of the learning community, submitting high quality work and participating actively in collaborative projects and group problem-solving. Mackenzie's portfolio was thorough and well-organized.

Mackenzie was an outstanding student who was very engaged week-to-week, in both the Physical Geology (fall) and the Environmental Geology (winter) components of the program. She was a leader in the learning community, with excellent attendance of the lectures and workshops, and she worked very hard over the course of the program. In the fall and winter, Mackenzie consistently completed her homework assignments on time and very well, demonstrating diligence and excellent understanding of the material. During group activities, Mackenzie was a leader in collaborating with fellow students, and helped student colleagues work through the material. In the fall, through in-class examinations, Mackenzie demonstrated an excellent understanding of topics related to the formation and differentiation of Earth, plate tectonics, and rock formation and then demonstrated an outstanding understanding of topics related to igneous, sedimentary, and metamorphic rocks and processes. Mackenzie worked hard over the quarter and again demonstrated an outstanding understanding of material on a final in-class examination including new topics in earthquakes, geologic dating, and historical geology.

In the winter, through in-class examinations, Mackenzie demonstrated an excellent understanding of topics related to geobiology and soil development and then demonstrated an outstanding understanding of topics related to biogeochemical cycling of nutrients in ecosystems. Mackenzie again worked hard over the quarter and demonstrated an outstanding understanding on the final in-class examination on climate systems and climate change. In the laboratory, Mackenzie worked hard to demonstrate excellent skills in mineral and rock identification through practical exams, in the fall. In the winter, Mackenzie developed introductory bench skills in the laboratory working on a project examining nutrient availability

in soils and was a very active participant during field trips examining coastal processes locally and in Olympic National Park.

Mackenzie's work in mathematics was excellent. She did outstanding work on the homework assignments in both fall and winter, submitting the work regularly and showing excellent persistence and success with the problems. Mackenzie's fall algebra tests showed very significant growth, and quite good skills by the end of the quarter though this is an area she could continue to work on. Her math labs provided useful reflection on her learning—including her growing enthusiasm for systems of equations and significant work on optional extension problems. Her work on the exams was excellent and showed steady improvement from very good at the beginning of fall to outstanding work by the end of winter quarter. Mackenzie's achievements in mathematics really reflect her engagement, commitment, and consistent effort with this work. She was a great contributor to class discussions—at times, one of the only students to solve some of the more advanced problems successfully.

In fall, Mackenzie completed an excellent final group project on rubidium-strontium dating. The group worked together very effectively, and submitted all of the drafts and assignments on schedule. Mackenzie was an active member of the team, and she put considerable effort into engaging with the complexities of the method. The group submitted an annotated bibliography which was of excellent quality and met all expectations of the assignment. Mackenzie's synthesis paper was also of high quality; it was well organized and gave an effective synthesis of three peer-revised papers on the method. The group's final presentation was great, showing smooth interactions among group members and a strong ability to respond to questions. Mackenzie provided great information and showed her strong competence with the material. Her slides were well constructed and effective; she could have spoken up a bit more but on the whole her explanations were strong and fluent.

Mackenzie's winter quarter project focused on mercury cycling. In support of this project she took on extra work in the form of learning how to use Evergreen's mercury analyzer (Nippon MA-3000) and contributing to analyzing their group's samples. She was a very active participant in field and lab experiences, and a leader in their research group. She completed her assignments in a timely manner, and her work was of very high quality. Mackenzie submitted the required four annotated bibliography entries, and an excellent final paper on mercury cycling soils beneath coniferous and deciduous forests. These writing pieces showed a high level of detail and a strong ability to work with primary literature and scientific writing. Mackenzie's group gave a terrific final presentation; Mackenzie contributed an detailed introduction to mercury cycling in forests, as well as an excellent discussion of sources of mercury to local forests and nearby research stations.

SUGGESTED COURSE EQUIVALENCIES (in quarter hours) TOTAL: 32

6 - Physical Geology with Laboratory
6 - Environmental Geology with Laboratory
8 - Precalculus I and II
4 - Statistics and Quantitative Reasoning in Geology
2 - Seminar and Library Research
6 - Guided Undergraduate Research in Earth Science

EVERGREEN

The Evergreen State College • Olympia, WA 98505 • www.evergreen.edu

EVERGREEN TRANSCRIPT GUIDE

Accreditation: The Evergreen State College is fully accredited by the Northwest Commission on Colleges and Universities.

Degrees Awarded: The Evergreen State College awards the following degrees: Bachelor of Arts, Bachelor of Science, Master of Environmental Studies, Master of Public Administration and Master In Teaching. Degree awards are listed on the Record of Academic Achievement.

Educational Philosophy:

Our curriculum places high value on these modes of learning and teaching objectives:

- Interdisciplinary Learning
- Collaborative Learning
- Learning Across Significant Differences
- Personal Engagement
- Linking Theory with Practical Applications

Our expectations of Evergreen Graduates are that during their time at Evergreen they will:

- Articulate and assume responsibility for their own work
- Participate collaboratively and responsibly in our diverse society
- Communicate creatively and effectively
- Demonstrate integrative, independent, critical thinking
- Apply qualitative, quantitative and creative modes of inquiry appropriately to practical and theoretical problems across disciplines, and,
- As a culmination of their education, demonstrate depth, breadth and synthesis of learning and the ability to reflect on the personal and social significance of that learning.

Our students have the opportunity to participate in frequent, mutual evaluation of academic programs, faculty and students. In collaboration with faculty and advisors, students develop individual academic concentrations.

Academic Program

Modes of Learning: Evergreen's curriculum is primarily team-taught and interdisciplinary. Students may choose from among several modes of study:

- **Programs:** Faculty members from different disciplines work together with students on a unifying question or theme. Programs may be up to three quarters long.
- **Individual Learning Contract:** Working closely with a faculty member, a student may design a one-quarter-long, full-time or part-time research or creative project. The contract document outlines both the activities of the contract and the criteria for evaluation. Most students are at upper division standing.
- **Internship Learning Contract:** Internships provide opportunities for students to link theory and practice in areas related to their interests. These full- or part-time opportunities involve close supervision by a field supervisor and a faculty sponsor.
- **Courses:** Courses are 2-6 credit offerings centered on a specific theme or discipline.

The numerical and alpha characters listed as Course Reference Numbers designate modes of learning and are in a random order.

Evaluation and Credit Award:

Our transcript consists of narrative evaluations. Narrative evaluations tell a rich and detailed story of the multiple facets involved in a student's academic work. A close reading of the narratives and attention to the course equivalencies will provide extensive information about student's abilities and experiences. Students are not awarded credit for work considered not passing. Evergreen will not translate our narrative transcript into letter or numeric grades.

Transcript Structure and Contents: The Record of Academic Achievement summarizes credit awarded, expressed in quarter credit hours. Transcript materials are presented in inverse chronological order so that the most recent evaluation(s) appears first.

Credit is recorded by:

Quarter Credit Hours:	Fall 1979 to present
Evergreen Units:	1 Evergreen Unit (1971 through Summer 1973) equals 5 quarter credit hours
	1 Evergreen Unit (Fall 1973 through Summer 1979) equals 4 quarter credit hours

Each academic entry in the transcript is accompanied by (unless noted otherwise):

- The Program Description, Individual Contract or Internship Contract which explains learning objectives, activities and content of the program, course or contract.
- The Faculty Evaluation of Student Achievement provides information on specific work the student completed and about how well the student performed in the program or contract.
- The Student's Own Evaluation of Personal Achievement is a reflective document written by the student evaluating his or her learning experiences. Students are encouraged but not required to include these documents in their official transcript, unless specified by faculty.
- The Student's Summative Self Evaluation is an optional evaluation summarizing a student's education and may be included as a separate document or as a part of the student's final self- evaluation.

Transfer credit for Evergreen programs, courses and individual study should be awarded based upon a careful review of the transcript document including the course equivalencies which are designed to make it easier for others to clearly interpret our interdisciplinary curriculum. These course equivalencies can be found at the conclusion of each of the Faculty Evaluation of Student Achievement.

The college academic calendar consists of four-eleven week quarters. Refer to the college website (www.evergreen.edu) for specific dates.

This record is authentic and official when the Record of Academic Achievement page is marked and dated with the school seal.
All information contained herein is confidential and its release is governed by the Family Educational Rights and Privacy Act of 1974 as amended.
If, after a thorough review of this transcript, you still have questions, please contact Registration and Records: (360) 867-6180.