Guardians of the Rock

Disto 3D Review
A game-changer?

Fearful Excitement
Surveys of David Douglas

Industrial Tolerances
Innovation from Sokkia
hen Scottish naturalist David Douglas returned to London from North America in the late fall of 1827, he was received with remarkable acclaim for the relatively unschooled son of a village stonemason. Working as a collector for the London Horticultural Society, he had traveled widely over the fertile grounds of the Pacific Northwest, and hundreds of the seeds he had sent back—including the tree that would eventually bear his name—had been successfully sprouted in the Society gardens. Within the next few months, Douglas wrote or contributed to more than a dozen scientific papers on subjects ranging from currant bushes to California condors, signed a book contract with a leading publisher, and was lionized by what was often a very strict class society.

Yet Douglas was determined to expand the scope of his work. He had studied the explorations of Alexander Mackenzie, George Vancouver, and Lewis and Clark, and had traveled with several members of cartographer David Thompson's crew; by seeing how their maps related to the country, he understood the value of careful surveying. While on the Columbia River, Douglas had befriended a Hudson's Bay Company surveyor named George Barnston, and notions of biogeography were percolating in his mind. Such ambitions required learning some basic surveying skills, and in London, quite by chance, Douglas found a willing teacher.

>> By Jack Nisbet
While collecting plants California in 1831–32, David Douglas calculated the coordinates of the Franciscan missions that offered him hospitality along the Camino Real.

Douglas portrait: Companion to Curtis’s Botanical Magazine, 1836
Map by Emily Nisbet.
Edward Sabine, the younger brother of Douglas’s boss at the Horticultural Society, had served as an officer in the Royal Navy during the War of 1812, taken early retirement, then turned his attention to the study of physical geography and the properties of terrestrial magnetism. As astronomer on Captain John Ross’s first Arctic expedition in 1819, Sabine developed a particular interest in the problems of finding magnetic north.

David Douglas shared lodgings with Sabine during his stay in London, and in 1828 began assisting him in his geomagnetic measurements. When the naturalist secured approval for a second collecting trip to the Northwest, he reached out to Sabine for some practical advice. “While preparing for his departure in the summer of 1829, I heard [Douglas] frequently express his regret that his limited education prevented his being able to render those services to the geographical and physical sciences,” Sabine later wrote. “He spoke with particular regret of his inability to fix geographical positions.”

Recognizing Douglas’s combination of seemingly boundless physical energy with “vigor of mind,” Sabine offered to serve as his friend’s tutor during the three months that remained before his scheduled departure. At the Royal Observatory in Greenwich, the two fell into a training regime as demanding as any military exercise. Based on his own practical experience, Sabine had a sense of how to feed his pupil “just so much knowledge of plane and spherical trigonometry, and of the nature and use of logarithms, as was essential for his practical purposes . . . For eighteen hours a day he bent all the powers of his mind to overcome difficulties, for which his previous education and habits had so little prepared him.”

Because of Sabine’s deep interest in the earth’s magnetic properties, Douglas received a very individual mode of astronomical instruction. The captain demonstrated how iron bars suspended from a tripod allowed an observer to measure “the relative intensity of magnetic attraction in different parts of the earth’s surface.” He acquainted Douglas

During his first trip to the Columbia, Douglas sent back viable seed for both the beautiful alpine wildflower called snow douglasia (Edward’s Botanical Register 1833) and the valuable timber tree we know now as Douglas-fir (Flora Borealis-Americana 1829).
with the use of the dip circle, a compass supported on gimbals that pivots on a plane to reveal the angle the magnetic field makes with the vertical. He also taught Douglas how to hang a magnetically charged needle from a tripod, and then watch as Earth’s magnetism made that needle vibrate. In London, such a needle suspended from a tripod with special asbestos thread twitched exactly one hundred times in three hundred seconds. By measuring slight differences in the frequency of those vibrations at other locations around the world, Sabine had begun to describe sweeping “isographic” curves that covered the earth in exactly the same way “that iron filings arrange themselves around a magnetized iron sphere.”

Sabine combined these experiments in magnetism with a thorough knowledge of standard nautical measurements, from the use of accurate temperature and dew point readings to determine altitude to the intricate trigonometry necessary to calculate latitude and longitude. In addition to the mariner’s sextant, Sabine taught Douglas to use a repeating reflecting circle—a larger, heavier instrument that contained two reflecting mirrors and a full circle rather than sixty degrees of arc. The teacher soon felt confident that with a few weeks of steady instruction, combined with the better part of a year to practice on the outbound ship, his pupil would be fully competent “to undertake a variety of determinations which might render his mission important to other branches of science besides those of natural history.”

With a Pacific Northwest boundary settlement between British Canada and the United States pending, the Colonial Office in London took an interest in Douglas’s newly acquired skills, and supplied him with a stipend to acquire both surveying manuals and a full set of secondhand but serviceable equipment. Edward Sabine, with a more sophisticated set of tools in mind, took Douglas to the shop of Dollond and Sons, the family that had supplied instruments for everyone from Captain Cook and Thomas Jefferson to David Thompson. Douglas’s final list included not only both a quality sextant and repeating reflecting circle, but also a Dollond compass, dip needles, and dip circle; a tripod, magnetic bars, and special asbestos thread to hang them on; two state-of-the-art chronometers; plus a thermometer, barometer, hydrometer, and hygrometer. The entire package weighed enough that in the field Douglas required an extra man to carry his equipment, and the competent use of such instruments would prove a daunting task for a novice. But then, his teacher had very lofty goals in mind.

The German polymath Alexander von Humboldt had first noted anomalies in the earth’s magnetic fields while traveling in South America in 1799-1804. He published a paper introducing the notion of a map that described them with parallel lines or “isotherms,” and developed a plan to employ scientists worldwide to collect the data necessary to chart them on a global map. By 1829, Edward Sabine was coordinating Humboldt’s project from the Royal Observatory in Greenwich. He assigned David Douglas to cover a significant portion of North America, and expected the naturalist to make a very real contribution to the undertaking.

As David Douglas progressed around Cape Horn on his 1829-30 voyage to the Pacific Northwest, Douglas traveled with fur trade horse and canoe brigades in the Columbia and Fraser River drainages, and followed the company’s Athabasca Pass trail across the Rocky Mountains.
Columbia River, he diligently practiced with the tools of his new trade. “How beneficial it is for a person like me to be at sea some months previous to engaging on a long journey,” he wrote to Sabine. “I have had time to think over and settle my plans; and I never suffered an opportunity to pass without endeavoring to perfect myself in the use of some instruments.” He developed a particular fondness for the dependability of Chronometer No. 201, and explained in detail how the reflecting circle lent itself to his present skill level—he found that the extra weight of the circle made it easier to bring his arm and eye together steadily down on the horizon, and believed it helped him take a more accurate shot.

When Douglas arrived at Fort Vancouver in June 1830, Hudson’s Bay Company clerk and surveyor George Barnston described with great delight the careful unpacking of his friend’s new tool kit. Barnston appreciated Douglas’s meticulous recalibration and trial of each device as he demonstrated his mastery over the full range of his new discipline. “His astronomical work advanced surely and rapidly. The regularity of barometrical and magnetical figurings was conspicuous, and the diurnal variations of temperature remarkably equal, the humidity of the atmosphere generally a mere trifle,” Barnston wrote. The clerk was equally impressed with his friend’s diligence as he calculated shot after shot for longitude, using two different methods of the time, to determine the exact position of Fort Vancouver. These coordinates would serve as his benchmark for future observations.

Traveling upstream to Fort Walla Walla, Barnston assisted Douglas in surveys at the confluence of the Snake and Columbia Rivers, a place of great importance to any British claims for the proposed international boundary settlement. As they set up their instruments, the pair would have been well aware that they were repeating observations taken by the Corps of Discovery in 1805 and by David Thompson in 1811.

Edward Sabine had hoped that Douglas would be able to take magnetic observations along overland fur trade routes through Oregon and into California, but a malaria epidemic coupled with an erosion of tribal relationships convinced the naturalist to travel by sea instead. Based in Monterey, Douglas spent the next two years working in California. He often stayed at Franciscan missions on the Camino Real, and although his personal journal for that time is lost, the survey notebooks he sent back to Sabine display a list of coordinates stretching north to Santa Rosa and south to Santa Barbara.

When he returned to Fort Vancouver from California in the spring of 1833, Douglas had his sights set on a northerly excursion that combined several of his stated goals. Traveling with a fur trade brigade north from Fort Okanogan to Fort Kamloops, then west to the Fraser River, Douglas arrived at Fort...
Alexandria in early May. This was the place where in 1793 another of his heroes, Sir Alexander Mackenzie, had broken off from that wild river to follow a tribal trail to the Pacific, and Douglas worked hard to determine an accurate latitude and longitude of the place. While at Fort Alexandria, he also spent an entire night observing how a particularly intense burst of aurora borealis affected his magnetic bars.

Douglas continued north to Fort Saint James, but rather than attempt an overland trek to a Russian outpost on the coast, he decided to return south via canoe. When he wrecked on the Fraser River he lost his personal journal, but did manage to rescue his surveying instruments and field notebooks. One of the notebooks contained a set of sketch maps depicting his route from Fort Okanogan to the junction of the Fraser and Quesnel Rivers, as well as a series of coordinates attached to landmarks that extended further north. His latitudes and longitudes represent the first accurate positions taken for those parts of the Okanogan and Thompson Rivers.

After canoeing back to Fort Vancouver, Douglas next departed for Hawaii, where he ascended Mauna Loa and Mauna Kea on the Big Island. At their summits, he took a series of barometric readings and coordinates; afterwards, by comparing his data with measurements taken by an American missionary from his home in Hilo at the same hour, he recorded the first accurate altitudes for both peaks.

Douglas wanted to make grand connections between magnetism and the volcanic geology he witnessed at Kileuea crater, and described the regular twitching and jerking motions in his needle there. “The cause was not permanent, but very variable; and did not arise from the accidental presence of any mineral substance, but from a sympathy between the magnetic action and that going on in the center of the volcano.” Here Douglas was feeling the subtle quakes that ripple deep within the earth under active fracture zones, and interpolating them into earth-changing events. “I cannot attempt to describe the sensations felt,” he wrote, “the even fearful excitement experienced during my visit to this place.”

Such exciting sensations always stirred Douglas’s interest. In his last report to Captain Sabine, in May 1834, Douglas wrote that although he intended to return to England at the first opportunity, he was far from being finished with his work. “I shall continue to labour at the islands,” he promised, “to the best of my ability.” The surveyor carried on his work until he perished in a cattle pit trap on the Big Island that July, at age 35. The missionaries he worked with shipped David Douglas’s survey books back to England, where his data contributed to pioneering work on geomagnetism that Edward Sabine published over the next several years.

Jack Nisbet’s books include Sources of the River and The Mapmaker’s Eye, which follow the work of pioneering surveyor and cartographer David Thompson. He is also the author of The Collector, about Scottish naturalist David Douglas in the New World. Nisbet’s upcoming title, David Douglas: A Naturalist at Work, will serve as the companion book for a museum exhibit of the same name that will open at the Northwest Museum of Arts and Culture in Spokane in fall 2012. For more details, go to www.jacknisbet.com.