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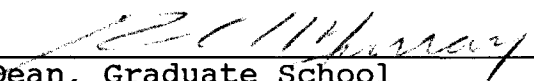
TAKING UP THE TOOLS:  
THE EARLY CAREER OF ROSSITER WORTHINGTON RAYMOND, 1867-1876

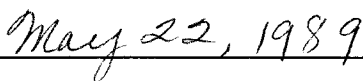
By  
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Presented in partial fulfillment of the requirements  
for the degree of  
Master of Arts  
1989

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History

Taking Up the Tools: The Early Career of Rossiter Worthington Raymond, 1867-1876 (142 pp.)

Director: H. Duane Hampton H.D.H.

Considered the "dean" of American mining engineers during the years between the Civil War and World War I, Rossiter Worthington Raymond (1840-1919) presided over an era that encompassed the industrialization of the Western mining frontier and the coming-of-age of the professional mining engineer. Raymond contributed significantly to both these developments during the course of a career lasting from 1867 to 1919. As editor of the influential Engineering and Mining Journal between 1867 and 1890, he spoke to and for the mining industry on a broad range of issues. As United States Commissioner for Mines and Mineral Statistics between 1868 and 1876, he traveled extensively throughout the West, compiling eight annual reports that documented the establishment and growth of Western mining. In 1871, Raymond and a handful of colleagues founded the American Institute of Mining Engineers (AIME), an organization dedicated to fostering professionalism and education among mining men. While Institute Secretary from 1884 to 1911, he edited over forty volumes of the AIME Transactions. As a consulting engineer and expert witness, Raymond's testimony in major Western mine litigations influenced the interpretation of American mining law.

This thesis concerns Raymond's background and early career (1867-1876), a period in which his work focused almost exclusively on the West. Raymond's life and Western experiences, and the attitudes shaped by those experiences, are examined through Raymond's own writings (editorials, correspondence, commissioner's reports, and AIME contributions), the memoirs of family and colleagues, and numerous secondary sources.

## ACKNOWLEDGEMENTS

Thanks are long overdue to Dave Emmons, Bill Farr, Harry and Nancy Fritz, Dale and Coby Johnson, Sara and Henry McClernan, and Claire and Leo Rhein for all their help and encouragement during the slow progress of this thesis; but thanks are most especially due my advisor, H. Duane Hampton, for not giving up.

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## INTRODUCTION

A Deidesheimer or a Rickard did more for the west than did a thousand gunmen like Wild Bill Hickock or Wyatt Earp.

--Otis E. Young, Jr.

Prior to the Civil War, mining in the American West was largely the domain of so-called "practical" mining men. As the term implied, such men had learned their occupation through actual practice in the mines. The best of them developed a sound understanding of mining principles through careful observation and experience. Unfortunately, most practical men combined experience with haphazard experiment, erroneous assumptions, and even superstition. As long as mining concentrated on easily worked surface deposits--placer mines--such erratic and wasteful methods were tolerated. However, the profitable development of quartz lodes required large-scale capital investment in mines and equipment. Investors, seeking predictable results, demanded a more rational approach to mining. Although the practical man "with a nose for ore" continued to dominate the industry well into the 1870s, a new breed of mining man appeared in the West after the Civil War: the professional mining engineer.

These engineers were educated men. They brought with them a knowledge of geology, chemistry, and physics. By bringing science and technology to Western mining, they introduced efficiency and order to a wasteful and chaotic industry. The resulting increase in stability and prosperity wrought benefits for the entire West. However, as mining historians Otis Young and Clark Spence have demonstrated, mining engineers were far more than technicians. They were businessmen, scientists, scholars, "molders of opinion", and leaders of men. In the process of bringing science to a mine, they frequently brought culture to the mining camp. Spence saluted mining engineers as "the Laceboot brigade," and it is true that most regarded their profession as a kind of crusade. In John Hays Hammond's words, the mining engineer was "a most important missionary of civilization."<sup>1</sup>

Among the most prominent of these "missionaries" was Rossiter Worthington Raymond (1840-1919). As editor of the influential Engineering and Mining Journal from 1867 until 1890 he spoke to and for the industry on a wide variety of issues. Between 1868 and 1876, Raymond traveled throughout the mining West as United States Commissioner for Mines and Mineral Statistics, compiling eight volumes of annual reports. Raymond's career as a consulting engineer spanned five decades. During those years his expert testimony was decisive in several major mine litigations (including Heinze-Amalgamated) and influenced the interpretation of U.S. mining

law. In 1871, Raymond participated in the founding of the American Institute of Mining Engineers and played a major role in its affairs until 1908.

By all accounts a major figure in his profession, Raymond has been largely overlooked by historians. To a certain extent this is due to the nature of his career, described in his own words as that of "interpreter, chronicler, guide and assistant to engineers . . ." He was not, he admitted, "a creative and constructive leader."<sup>2</sup> Perhaps it was inevitable that such a man would be overshadowed by the dramatic deeds of men like Clarence King or John Wesley Powell. Raymond refused to write his memoirs, and outlived those who might have contributed substantially to his biography. Historians have also been thwarted by the destruction of Raymond's papers, including field notes and diaries, in a house fire not long after his death. The San Francisco earthquake and other mishaps claimed other major collections of Raymond material.<sup>3</sup> As a result Raymond's role in Western mining is known chiefly through his commissioner's reports and Journal editorials. He appears only in anecdotes or as a cited source in mining histories. He remains a prominent but ill-defined figure.

In examining Raymond's career it is important to recognize that it consists of two relatively distinct periods. The first, or "Western" phase of his career roughly coincided with his tenure as United States Commissioner of Mines, 1868-

1876. During this time he guided the Journal through its difficult early years, writing several hundred editorials and articles that reflected the industry's emphasis on the Western mines. At the same time he traveled extensively in the West inspecting mines for his annual report to Congress on the condition of the industry.

In 1876 Raymond resigned as Commissioner and returned to his private consulting practice. This marked the beginning of a second phase in his career. By this time Raymond shared his editorial duties with Journal partner Richard P. Rothwell. Although he continued to travel in the West as a consultant, the focus of his attention had shifted from the Western mining industry to the needs of the mining engineering profession itself. He devoted the rest of his life to managing the affairs of the American Institute of Mining Engineers.

At the end of his life, Raymond's colleagues--nearly all younger men--regarded Raymond's effort on behalf of his profession as the major and most significant aspect of his career. What they did not understand was that those efforts were largely a result of Raymond's earlier experiences in the West. Those experiences, and the attitudes they engendered, are the subject of this thesis.

## ENDNOTES

<sup>1</sup>Clark C. Spence, Mining Engineers in the American West: The Laceyboot Brigade, 1849-1933 (New Haven: Yale University Press, 1970), p. 370; Otis E. Young, Western Mining: An Informal Account . . . From Spanish Times to 1893 (Norman: University of Oklahoma Press, 1970), p. 286.

<sup>2</sup>Rossiter Worthington Raymond in Rossiter Worthington Raymond: 1840-1910, ed. Charles W. Goodale (n.p., 1910), p. 51.

<sup>3</sup>Edmund Wilson, Jr., "Profiles: Landscapes, Characters and Conversations from the Earlier Years of My Life," The New Yorker 43 (29 April 1967), p. 114; T. A. Rickard, Mining and Scientific Press (11 October 1919):507; John R. Howard, Remembrance of Things Past: A Familiar Chronicle (New York: Thomas Y. Crowell Company, Publishers, 1925), p. 403.

## CHAPTER ONE

### BROOKLYN BEDROCK: THE RAYMOND AND HOWARD FAMILIES

Born in Cincinnati, Ohio on April 27, 1840, Rossiter Worthington Raymond was the eldest of seven children of Robert Raikes Raymond and Mary Anna Pratt Raymond. He spent most of his early childhood in Hartford, Connecticut where his father, a Baptist minister, held a pastorate. In 1847 the family moved to Syracuse, New York, where Robert Raymond continued his ministry and, during the early 1850s, edited local newspapers.<sup>1</sup>

In Syracuse, Raymond met the rest of the sizeable Raymond clan, families of his father's brothers and sisters. Raymond's uncle, John Howard Raymond, was an English professor at Rochester University. His home in nearby Hamilton became the summer retreat for the Brooklyn-dwelling Raymond families, particularly Raymond's Aunt Susan (Mrs. John Tasker Howard) and her children.<sup>2</sup> According to John H. Raymond, "summer vacation" was a tradition initiated by Raymond's grandfather Eliakim:

. . . it was my father's custom every summer, as soon as the dog-star began to rage, to send all his family away from the hot and pestilential breath of the city . . . we spent the golden months in country

sports . . . learned to ride and drive, to swim and fish, to sail a boat, and do a thousand things for which the city offers no opportunities to its pallid sons.<sup>3</sup>

Eliakim's sons and daughters likewise encouraged an appreciation of nature and outdoor activities in their children. Rossiter spent much of his boyhood "camping and tramping and playing Indians" with his brothers in the woods around their Syracuse home.<sup>4</sup>

Another Raymond family custom was that of early schooling for the boys. Like his father and uncles, Rossiter began his lessons at home while only a few years old. Accounts of his childhood indicate that he was a willing student, learning the Greek alphabet and mastering a Greek primer by age six. From 1847 until 1856 he attended the Syracuse public schools.<sup>5</sup>

In addition to this formal training, Rossiter also benefitted from exposure to the highly literate company of the Raymond family circle. A family friend, Mrs. T. J. Conant, described the summer gatherings at Hamilton that consisted of various Raymonds and several professors and clergymen from the area:

To . . . social enjoyments were added more substantial pleasures. An evening every week was sacred to literary studies; to readings in favorite authors with criticisms on their peculiar characteristics and merits, interspersed with written essays, translations from the German poets, and the like.<sup>6</sup>

Elizabeth Barrett, William Thackeray and Charles Dickens were particular favorites among the Raymonds, with one or another

of the group often presenting dramatic readings. The younger family members participated in these entertainments: ". . . the thoughtful younger tribes would cuddle in corners, or crowd behind the chairs of their elders to enjoy . . . a vocal interpretation of a favorite author."<sup>7</sup> Young Rossiter's reading apparently was not limited to such respectable, serious literature. At least one early pulp novel about the West found its way into his hands, and the boy named his rowboat "Ayacanora" after the "beautiful savage" in James K. Paulding's Westward Ho!<sup>8</sup>

The Raymond family also exhibited a deep commitment to religion. Rossiter's father Robert had abandoned his study of law (in the Cincinnati office of Salmon P. Chase) to follow his older brother John into the Baptist ministry. Their brother-in-law George R. Bliss was a Baptist clergyman and theologian. In the early 1800s, Rossiter's grandparents Eliakim and Mary Carrington Raymond had migrated from Connecticut to New York, partly as a result of their decision to give up Congregationalism in favor of Baptist beliefs. A granddaughter later explained, ". . . they acted on their convictions, at the sacrifice of a thousand precious privileges and associations." Such firm adherence to religious principles led in turn to the family's active involvement in social and political causes, particularly the abolition of slavery.<sup>9</sup>



Like many other clergymen in Western New York during the 1850s, Robert and John Raymond were strident anti-slavery men. In Rochester, John Raymond's speeches and fund-raising efforts on behalf of the cause earned him the friendship of abolitionist leaders Frederick Douglass and W. H. Channing. In Syracuse, the more radical Robert played an active role in the so-called "Jerry incident" in which an abolitionist mob "rescued" a fugitive slave from authorities.<sup>10</sup> Robert also "with much skill and secrecy but with the clearest of consciences" operated an underground railway "station" in his home. On at least one occasion eleven-year-old Rossiter and his younger brother Charles encountered a fugitive slave being interviewed by their father. The slave's account of his separation from wife and children had a profound effect on the boys. Rossiter often recounted the incident later in life, and his daughter Elizabeth believed that it marked the beginning of his "headlong, uncalculating partisanship of his fellow-man--especially his fellow-man in trouble."<sup>11</sup> In any event, it seems likely that his later editorial campaigns and willingness to engage in controversy had their roots in his family's abolitionist crusade.

In 1855, Brooklyn Polytechnic Institute named John H. Raymond as its first president. This fulfilled his long-held hope of rejoining his brother Israel and sisters Susan and Mary Ann and their families in Brooklyn. As the school's president, John Raymond used his influence to complete the

family circle by securing a faculty position for Robert Raymond. And so, in 1856, Rossiter began his lifelong residence in Brooklyn.<sup>12</sup>

The Brooklyn Raymonds were close, both emotionally and geographically. Family life centered in the home of Rossiter's Aunt Susan and her husband John Tasker Howard, located in the area known as Brooklyn Heights. "Uncle Tasker" was a prominent New York merchant shipper whose company traded in South America and Russia. His steamship line, backed by San Francisco merchants, was among the first to connect the Isthmus of Panama with San Francisco at the beginning of the California gold rush. Howard was also an "original Republican" with both business and personal ties to John C. Fremont. During the 1856 presidential campaign, Fremont used Howard's New York office as a headquarters, with Howard himself serving as the Pathfinder's "private banker." The entire Raymond-Howard clan embraced Fremont's anti-slavery cause.<sup>13</sup>

Immediately next door to the Howards lived the family of John Howard Raymond. Mrs. John Tasker Howard described the close relations of the two families: ". . . for eight happy years we lived side by side. A door was cut through our connecting piazzas that we might have free-intercourse, and . . . our daily lifestreams blended."<sup>14</sup> President of Brooklyn Polytechnic Institute, John Raymond was also a minister, English professor, classics scholar and an early women's

rights advocate who worked to increase educational opportunities for women. He later served as president of Vassar College.<sup>15</sup> According to his sister Susan (Mrs. John Tasker Howard), he was the central influence in the clan, particularly among its younger generation:

Every debatable matter whether in the conduct of life, in religions, in sciences, in esthetics, in politics --or whatever might be the point of difference--was referred to him. Among the young cousins nothing was more common than the remark, "I will ask Uncle John," or the question, "Will you leave it to Uncle John?" . . . he was always accepted referee.<sup>16</sup>

When the Robert Raymond family arrived in Brooklyn in 1857, they took up residence around the corner from the John Raymonds and John Tasker Howards. During their summers at Hamilton, Rossiter had become best friends with his cousins John and Anstiss (Annie) Howard. Along with numerous other Raymond relatives, he spent a great deal of time at the Howards'. In the late 1850s that household was a lively place, as the Howards and the three Raymond families included at least sixteen children between infancy and age eighteen, not counting a few grandchildren. Added to this, on occasion, were the thirteen children of George and Mary Ann Raymond Bliss.<sup>17</sup> John Howard recalled the scene, and the beginning of his friendship with his cousin "Ros":

The younger children made a merry group although not quite old enough for our comradeship, but we both [John and Annie] found a comrade in Rossiter, who was younger than I by about two years. But he was of unusual forwardness in understanding and spirit. . . . Thus we quickly harmonized. He was generous of impulse, and had a native wit with a quick intelligence and literary sense. Moreover, he had

the good taste to be bewitched by his lovely cousin Annie.<sup>18</sup>

The entire clan gathered weekly at the Howards', where Mrs. Howard continued her father's custom of holding prayers at five o'clock every Sunday afternoon, followed by dinner. Included in the family circle on these and other occasions was the fiery preacher Henry Ward Beecher, pastor of Brooklyn's Plymouth Church. Beecher's ties to the Raymond family began in 1847, when John Tasker Howard and the other founders of Plymouth Church invited Beecher to head their congregation. The Beechers and Howards became close friends. In the 1850s, Beecher's abolitionist activities brought him into an equally close association with John H. Raymond. When Robert Raikes Raymond moved to Brooklyn in 1856, the preacher so impressed him that Raymond gave up his Baptist ministry to join Beecher's Congregationalist flock.<sup>19</sup>

Beecher's effect on the younger family members was no less profound. It was said that, as a result of Beecher's influence, "To all the children and young folks . . . and to Rossiter not least, the affairs of the Kingdom of Heaven were as vital and interesting as their school doings or their plans for vacation."<sup>20</sup> Rossiter became a devoted friend of Beecher and played a vital role in Plymouth Church for the rest of his life. However, Beecher's influence was not entirely religious. The pastor had spent the early years of his ministry as a missionary in Indiana, and often entertained the

young people with inspirational stories of life on the frontier of the 1830s.<sup>21</sup> Nevertheless, he tried to dispel any romantic notions they held about the West. Of his experiences as a circuit-rider he said simply:

I was sent into the wilderness of Indiana to preach among the poor and ignorant, and I lived in my saddle. My library was in my saddle-bags. I went from camp-meeting to camp-meeting, and from log hut to log hut.<sup>22</sup>

Beecher was among those who feared that the West's lack of civilization would have a degenerative effect on the rest of society.<sup>23</sup>

If Beecher's picture of the West was undramatic, Rossiter and his cousins surely received a very different impression from General Fremont, who paid occasional visits to the Howard home. From 1857 until 1861, John Tasker Howard was Fremont's partner in securing financial backing for the development of gold mines on Fremont's Mariposa Estate in California. It is improbable that the presence of a national hero, his stories of adventure in the West, and talk of gold mines would be without effect on Ros, his brother Charles and their cousin John Howard, all then in their teens.<sup>24</sup>

Less dramatic, but perhaps no less influential, was the presence of another uncle, Israel Ward Raymond, who lived in Brooklyn during the middle and late 1850s. Israel had followed his father Eliakim into the fur import and manufacturing business. He later joined John Tasker Howard in the steamship company of J. Howard and Son, eventually

marrying Howard's sister. In 1848 he represented the firm aboard one of the first steamships carrying passengers to the California gold fields, spending a year there before returning to New York. Serving for a time as vice-president and agent of the powerful Pacific Mail Steamship Company, he participated in the first sidewheel-steamer crossing of the Pacific, sailing from San Francisco to Australia in 1853. According to John Howard, Uncle Israel was "a dignified, clear-headed, kindly man with a goodly share of the shrewd wit of his kin." A favorite of his nieces and nephews, he enjoyed sharing his experiences with them. His memories of California were bright ones, for in 1858 he moved his family permanently to San Francisco. There he later played a vital role in the creation of Yosemite Park.<sup>25</sup>

Much of the talk around the Raymond and Howard homes, then, was bound to kindle the imagination of a seventeen-year-old. Perhaps Rossiter watched with envy in early 1858 as his cousin John accompanied General Fremont, John Tasker Howard and mining engineer Justus Adelberg westward to California and the Mariposa mines. But, within a few months, he, too, would leave the familiar confines of Brooklyn. After graduating first in his class at the Polytechnic Institute, Rossiter Worthington Raymond, son of a minister and English professor, raised in an environment of refined culture within a family committed to social and spiritual causes, sailed for Europe

to become a mining engineer. He was, he later explained, "a youth in search of fortune."<sup>26</sup>

Young Raymond soon found adventure on the high seas. Enroute to England in the summer of 1858, a series of disasters struck his ship, the old Black Ball clipper Great Western. The eighteen-year-old was pressed into service as a third mate for a good part of the voyage and thereafter considered himself a sailor. Years later he delighted in telling how the battered ship "with half a rig and half a crew, and on half allowance of water, . . . finally crawled through the Irish channel to Liverpool, a surprise to her underwriters!"<sup>27</sup>

Although education was the purpose of Raymond's trip to Europe, the details of his activities during 1858-1859 remain sketchy. After a year at Heidelberg University in Germany (where the renowned Robert Bunsen taught chemistry and geology), Raymond continued his studies at the University of Munich as a student of Franz von Kobell.<sup>28</sup> In early 1859 Raymond visited Berlin, where he met the great natural scientist and world explorer Alexander von Humboldt shortly before the latter's death. Von Humboldt made a deep impression on Raymond, who later wrote of the experience, ". . . we looked upon the last of the world-embracing, world-controlling thinkers."<sup>29</sup>

Raymond's life during this period was not entirely occupied with academic pursuit. He enjoyed numerous holidays roaming the German countryside and sightseeing in the cities. In the summer of 1859, Raymond and six other American students spent a month wandering the Tyrol. The "Seven Jolly Gentlemen" as Raymond called the group, passed the time in "political and philosophical debate, jokes, raillery, chess and song." Raymond was captivated by the Alpine scenery, and his diary revealed the beginning of a lifelong love of mountain landscape.<sup>30</sup>

In January 1860, after concluding his studies at Munich, Raymond, Frederick Stowe, and Sam Scoville crossed the Alps on foot to join the John Tasker Howard family in Florence. The Howards, including Raymond's cousins John and Annie, were touring Italy with Harriet Beecher Stowe (Frederick's mother). At the Austrian border, the three students were detained by Garibaldian partisans. Raymond was arrested as a spy, but he secured his release and the party's safe passage by delivering a rousing patriotic address to his captors.<sup>31</sup>

The reunion with John Howard in Florence was a joyful one. The cousins had much to tell each other. No doubt Howard entertained Raymond with stories of his visit to the Mariposa estate, during which he had been caught up in the Hornitas miners' rebellion. In spite of such dangers, however, Howard remembered California as "an earthly delight."<sup>32</sup> Although less exciting, Raymond's account of his



months in Germany must have been attractive, for his cousin joined him there the following spring. Raymond and his traveling companions remained in Italy for nearly four months. While the Howards and the Stoves toured by coach, the three students roamed the country on foot, joining the main party in Florence, Milan, and Rome. During these gatherings, which at Rome included Robert and Elizabeth Browning, the families took up their customary literary pursuits.<sup>33</sup> Raymond was frequently called upon to display his writing talents and revealed himself as a poet. His Aunt Susan recorded the event in her diary:

Mrs. Stowe has promised a story for this evening. Ros Raymond is to give us a poem. Poor Ros! The girls torment him for poetry, and he has certainly been prolific today. It is his twentieth birthday, and he wrote some very pretty lines to Annie in a little book that he had given her for pressing flowers.<sup>34</sup>

The group disbanded in May, with Raymond returning to Germany. At his cousin's departure, John Howard wrote that Raymond had been "the best of good company for mortals of any age or quality--fertile, energetic, and whether for sense, nonsense or sentiment, ever ready to do more than his part, yet . . . never overdoing it."<sup>35</sup> Tragically, the happy memories of the months in Italy were soon blighted by Annie's sudden death. The news reached Raymond shortly after his arrival in Freiberg, Saxony. According to his family, the loss of Annie affected him "with all the force of a first great experience of grief."<sup>36</sup>

After returning to Germany in June 1860, Raymond enrolled at the Royal Academy of Mining (Königliche Sachsische Bergakademie) at Freiberg. Though numerically small (never more than 100 students), it was recognized as the finest school of its kind. Freiberg's prestige in mining was often compared to that of Heidelberg and the Sorbonne in the arts and letters. Since its founding in 1765, the Bergakademie's alumni and faculty included such prominent figures in the natural, chemical, and geological sciences as von Humboldt (1791), A. G. Werner (1775-1817), Friederich Mohs (1818-1826), F. A. Breithaupt (1813-1866), C. F. Plattner (1842-1858) and C. B. von Cotta (1842-1872). In addition to a distinguished academic tradition, Freiberg offered a practical curriculum that was considered highly innovative for its time. Located in the centuries-old silver mining district of the Mulde Valley, twenty miles southwest of Dresden, the school's access to nearby mines and smelters enabled it to combine academic theory with actual mining practice.<sup>37</sup>

Because Freiberg's reputation attracted students and scientists from most of the world's far-flung mining districts, it was a highly cosmopolitan community. Here Raymond experienced what fellow alumnus Frederick Corning later described this way: ". . . men of all ages, hues, customs, civilizations, presenting an international ensemble of striking, engaging contrasts. . . . Many languages suggesting the Biblical Babel . . . heard on the streets, in

the cafes, and in the corridors of the Academy." In 1860, Raymond was one of the only five American students at Freiberg, all forced to seek their education abroad by the absence of a mining school in their own country.<sup>38</sup>

Raymond was fairly typical of the young men then studying mining at Freiberg. The high cost of technical education and the Bergakademie's rigorous entrance exams ensured that most students were, like Raymond, above-average scholars from upper-class families. Many came from families involved with mining, or had "other familiarity with the work and life of the engineer."<sup>39</sup> In Raymond's case, his considerable exposure to discussion of mines and mining (through his uncles' involvement in the Mariposa venture and California steamship interests), along with his love of the outdoors and youthful thirst for adventure made mining engineering a logical choice. German-born engineer and family friend Justus Adelberg was also a likely influence on Raymond's choice of career and school. John Howard, who also pursued a mining education, explained his decision this way:

My inclination to study for the ministry, never very urgent, had disappeared. . . . I was, however led to feel that, since my need for physical reasons apparently lay in an out-of-door life, the interest I had already found in mining affairs opened a congenial and valuable pursuit. My father was even then interested not only in Mariposa gold but in new discoveries of tin in California.<sup>40</sup>

Although it was a radical departure from the family pattern, there is no indication that the educators, ministers,

and businessmen of the Raymond-Howard family disapproved such a career. During the 1850s and 1860s, most American mining students received encouragement from their families, since it was generally recognized that mining engineering offered a promising future. As with industry in general during the mid-19th century, mining was increasingly complex. More sophisticated machinery and techniques replaced earlier, simpler methods. As the easily-worked placers of California and Nevada played out, so-called "practical" or self-taught mining men confronted the more difficult technical problems associated with hardrock mining and base metals. Solutions to these problems required extensive knowledge of geology, chemistry, and engineering. The resulting demand for trained mining engineers, coupled with the attractive drama of life on the Western frontier, imbued the profession with the prestige of being both lucrative and exciting.<sup>41</sup>

Raymond had previous college experience, as did the majority of Freiberg's students. Nonetheless, he found the Bergakademie curriculum challenging. The school offered degrees in four general areas: Mining Engineering, Metallurgy, Mine Surveying, and Iron Mining and Metallurgy. Students had the options of concentrating on a general field, specializing within a field, or combining studies in two or more areas. Depending on the student's area of study, coursework usually included higher mathematics, descriptive geometry, mechanics, experimental physics, mineralogy,

paleontology, mining concentration, ore deposits, mine surveying, and mine machinery. Degree candidates were also required to complete a course in German mining law and to prepare a thesis on an assigned engineering problem.<sup>42</sup>

The practical aspect of Freiberg's program was no less demanding. Incoming students participated in a four-month preparatory course in mining and milling practices before their admission to regular classes in October. During this orientation, students spent a minimum of thirty hours per week in the mines and smelters. The physical strain of this and subsequent practical courses was considerable. As a result, any sign of physical unfitness for mining work could result in a student's exclusion from the Academy. Students worked long hours, either rising before dawn, or accompanying the night shift into the mines. Their tasks ranged from observation and note-taking to actual mining and smelting labors. Working conditions were often uncomfortable, improved only slightly by the traditional student-miner's garb: brimless, felt-topped hat with lamp, leather apron (for sitting in damp places), and tall boots. Raymond enjoyed his hours in the mines and his association with German miners. The miners were, he wrote, "grave, earnest, honest, very religious and full of strange fancies and legends--the fruit of . . . solitary underground life." He was fascinated by their superstitions and customs, such as the singing of hymns at the change of shifts, complete with candlelight and organ

music. Most students, however, agreed with fellow Freiburger Alexis Janin, who found the entire practical program "most fatiguing."<sup>43</sup>

Few details are known regarding Raymond's academic career at Freiberg. According to John Howard, Raymond began the study of mining engineering at Heidelberg and Munich. Apparently then, Raymond was a third-year student or senior at Freiberg. A three-year program, which did not result in a formal degree, was the option selected by most American students. They thought that the regular degree curriculum was "top-heavy" with tedious, unnecessary courses, and that the three-year course was comprehensive enough to enable them to practice as mining engineers in America.<sup>44</sup>

Non-degree students did not undergo examination in their fields. Therefore, they could, if they chose, do very little. Raymond appeared to be among the more serious students. Those who knew him praised his eagerness and envied his efficient work habits. Raymond described his approach to his studies this way:

I gained a full year over the time prescribed for German students, by giving myself wholly to my special courses. It is comparatively easy, in such a case to keep out of "society" . . .<sup>45</sup>

Raymond however, did not totally withdraw from society at Freiberg. Soon after his arrival there, he participated in the formation of the Anglo-American Club for English-speaking students. The group maintained a reading-room of

English language publications, but was better known for less-intellectual activities. Of particular interest in Freiberg were the Club's frequent athletic competitions, including baseball games, cricket matches, and skating exhibitions. These events puzzled the quiet, orderly Saxons who, a club member recalled, "thronged the field under mental strain to discern the hidden meaning and joy of it all." The Anglo-Americans also vigorously upheld more traditional German student customs, such as the ritualistic "beer duel." The enthusiasm of some members for such pursuits led to an allegation that Americans spent more time in the Biergarten than in the classroom.<sup>46</sup>

An active Anglo-American, Raymond exhibited a "convivial spirit" and readiness to engage in revelry. Characteristically, however, he appeared to avoid the excesses of fellow members. As at Heidelberg and Munich, he spent his holidays in travel and sightseeing. His usual companions included his roommate John H. Boalt, W. S. Keyes, "a curly-headed Englishman named Bowers," and the German Augustus Steitz.<sup>47</sup> By Raymond's own account, his days at Freiberg were

. . . days of study and practice both above and underground . . . jovial evenings of science and song and Kartoffelsalat . . . strolls along the shady Graben . . . longer walks to the Hutten . . . foot journeys with knapsack and staff, to Dresden or Chemnitz, and once far into Bohemia--fit scene of travel for our light Bohemian hearts. . . . happy days . . . in which if one-half was hard work, the other half was certainly (for the soul that could comprehend it) equally compounded of romance and laughter.<sup>48</sup>

For Raymond, those light-hearted days came to an end in the spring of 1861. In April he welcomed John Howard to Freiberg. Howard had just completed a tour of British mines with his father's engineer Justus Adelberg, who tutored him in mining subjects. He planned to continue his studies and improve his German before enrolling at the Bergakademie in October. In view of his cousin's plans, it appears that Raymond also intended to remain in Freiberg the following year. Whatever their plans, events in the United States soon intervened. During the first week of May, newspapers and letters from home announced the outbreak of the Civil War. The Americans at Freiberg greeted the news with excitement. Unlike pacifist abolitionists, Raymond and Howard applauded the conflict as a moral crusade and appealed to their parents for permission to return home. As Howard wrote to his father, "I cannot endure to hear of my friends and companions thronging to this Holy War and I myself stand on one side and see them pass me in the race of duty." Raymond expressed similar sentiments to his family and, with the other Americans eagerly awaited a summons home. In the meantime, like others of their age, the young men engaged in war-talk, regarding the conflict as a glorious adventure.

Our military ambitions rose no higher than to join the ranks of the volunteers with musket and knapsack; unless perhaps we glowed at the athletic deeds of Ellsworth's and Hawkins' Zouaves, and imagined ourselves in blue jackets, baggy red breeches and scarlet fez, ready to be and go and do as ordered.<sup>49</sup>



Initially the response from home was discouraging. "No use to come: nothing doing." Unlike their friend Henry Ward Beecher, who threatened to disown his son if he did not enlist immediately, the Raymonds and Howards were not eager to send their sons to war. Besides, they wrote, there was already a surplus of volunteers in New York.<sup>50</sup>

Finally, in early June, the families relented and the young men received permission to come home. John Howard left Freiberg immediately, with high hopes of an appointment to General Fremont's staff. His father had been with Fremont in London when the General received orders to assume command of the Western Department of the Army, encompassing most of the region between the Mississippi and the Rockies. The senior Howard reminded Fremont of John's "California experiences" and the general promised to find a place for John on his staff. Raymond remained at Freiberg for several weeks, completing his studies.<sup>51</sup>

When Raymond returned to Brooklyn in late July or early August, he found John still awaiting an appointment to military service. The cousins discussed entering the Brooklyn Phalanx or New York Seventh Regiment, believing that anything was preferable to idleness. At last John Tasker Howard secured a letter from Fremont requesting his son's appointment to this staff as a Captain of the corps of "Additional Aides-de-Camp." The purpose of the corps was to enable generals to select their own officers for detail or appointment to their

personal staffs. John and his father departed for Fremont's headquarters in St. Louis, while Raymond remained in Brooklyn.<sup>52</sup>

John Howard's duties on Fremont's staff were those of aide-de-camp and private secretary. A few days after his mid-August arrival, he secured a similar position for Raymond. Fearing that his cousin might not be satisfied with a clerk's position, Howard wrote to his mother:

. . . if Ros don't want the place, I think he can get a position in the army directly. I tho't after I had done it, that perhaps he wouldn't thank me for it, but the Gen. was asking about another man, and I impulsively put in for Ros.<sup>53</sup>

The fact that Raymond did not arrive in St. Louis until September 11 may have reflected some ambivalence on his part. Nonetheless, he performed his duties well, and within a few weeks received an official appointment to the staff with the rank of lieutenant. Howard, a captain, felt certain that his ambitious cousin soon would have a chance to earn equal rank "in the field."<sup>54</sup>

Initially, however, the cousins' duties confined them to Fremont's office at Western Department Headquarters, an elegant old St. Louis mansion. There, in a large parlor filled with tables and maps, the aides attended Fremont as he dealt endlessly with officers, politicians, and favor-seekers. Although there was little excitement, Raymond had the opportunity, amid the "maps and plans and papers and reports"

of the Western Department, to familiarize himself with a West he had not yet seen.<sup>55</sup>

Raymond received his first taste of life in the field in late September when Fremont's army moved against Confederate troops near Jefferson City, Missouri. Initially, it was an enjoyable experience for the outdoor-loving Brooklynites: "Our camp life is just the jolliest imaginable. . . . Our cots, mess-chests, baggage, horse equipt, etc., fill up the tent pretty well, but we are comfortable." This light-hearted existence soon gave way to the realities of duty at the front. Frequent courier assignments kept the aides in the saddle day and night, often in driving rainstorms. In spite of the hardships, the cousins regarded these duties as a sign of Fremont's confidence in them, and they responded with intense loyalty to their commander.<sup>56</sup>

In October 1861, charges of graft and mismanagement brought to a head the controversy that had surrounded Fremont since his ill-conceived emancipation proclamation in late August. The general's supporters, including Raymond and Howard, attributed the attacks to jealousy on the part of Lincoln and the War Department. Involved in the accusations were arms purchases for which John Tasker Howard had acted as agent. When Fremont was relieved of command in November, both Raymond and Howard rejected invitations to join other regiments. They chose instead to accompany Fremont to New York, "to assist in his defense." Wrote Howard to his family,

"We have no reason to be ashamed of the little finger we have had in the pie of the W. D.!"<sup>57</sup>

That winter, Fremont traveled to Washington, D.C., summoned before the Congressional Commission on the Conduct of the War. Again, his aides accompanied him. In recognition of their loyalty, the general promised them staff positions if he regained a command.<sup>58</sup>

In March 1862, following his acquittal, Fremont was given command of the Army's newly-created Mountain Department, operating in the Appalachians. He reappointed Raymond and Howard as aides, and advanced their respective ranks to captain and major. Howard declined his promotion, explaining that he and Raymond were competing to earn a major's rank in action. (Neither man accomplished this.)<sup>59</sup>

In the fall of 1861, during the Missouri campaign, Raymond had demonstrated his engineering ability in the rebuilding of a vital bridge on the Osage River. Using labor from the ranks, he successfully directed the construction of an 800-foot-long pontoon bridge. The entire project, including timber-cutting, was completed within 36 hours. Perhaps remembering that accomplishment, Fremont now gave Raymond the responsibility of establishing the general's headquarters camp near Franklin, West Virginia. Using troops of Blencker's German Division, Raymond designed and constructed "Camp Jessie," named in honor of Mrs. Fremont. The project earned praise for the young captain: ". . . [he]

did it in fine style, his facile German tongue, American energy and engineering sense securing effective and even artistic zeal from the troops."<sup>60</sup>

While at Camp Jessie, Raymond and Howard again enjoyed "the charm and restfulness of life in the field." But the brief respite ended with the resumption of unrelenting courier assignments. As Howard described it, the duty kept both men "riding on the march in broiling sun by day and on errands in chilling rains by night," camping in the mud, often with only a "pair of blankets and a bite in the saddlebags." Their performance earned official commendation for gallant and meritorious conduct, but the strenuous service took its toll. Stricken by dysentery, Raymond was absent from duty for much of May, rejoining the command in early June. Suffering a relapse later that month on the Shenandoah, he took leave and returned to Brooklyn for several weeks of bed-rest.<sup>61</sup>

Raymond's departure from camp coincided with that of General Fremont. Fremont's Mountain Department was to be consolidated with two other commands in the newly-created Army of Virginia under General John Pope. Rather than be subordinate to Pope, whom he held partly responsible for his removal in Missouri, Fremont requested and received relief from command. His personal staff, including John Howard, accompanied him to New York.<sup>62</sup>

Although still officially an Army captain, and addressed as such, it is unclear whether Raymond had any

assigned duties after his convalescence. Possibly he continued on Fremont's staff, as did John Howard until the summer of 1863. Raymond spent at least part of late 1862 or early 1863 at work on a German translation of Jessie Benton Fremont's book The Story of the Guard. Both the book and its translation Die Leibgarde were published later that year.<sup>63</sup>

War Department records show that Rossiter W. Raymond's military service ended with his resignation on April 6, 1864. He was, in fact, by that time several months into his civilian career as a mining engineer.<sup>64</sup>

## ENDNOTES

<sup>1</sup>Engineering and Mining Journal 107 (18 January 1919): 135; T. A. Rickard, ed., Rossiter Worthington Raymond: A Memorial (New York: American Institute of Mining Engineers, 1920), pp. 12, 14.

<sup>2</sup>John R. Howard, Remembrance of Things Past: A Familiar Chronicle (New York: Thomas Y. Crowell Co., Publishers, 1925), p. 5; Harriet Raymond Lloyd, Life and Letters of John Howard Raymond (New York: Fords, Howard and Hulbert, 1881), pp. 30, 107.

<sup>3</sup>Lloyd, Life and Letters, pp. 35-45.

<sup>4</sup>Elizabeth D. R. Bellinger in Rossiter Worthington Raymond: A Memorial, ed. T. A. Rickard, pp. 20, 126; J. R. Howard, Remembrance, p. 64.

<sup>5</sup>Bellinger in Memorial, p. 19; J. R. Howard, Remembrance, pp. 3-4.

<sup>6</sup>Lloyd, Life and Letters, pp. 125-126, 169.

<sup>7</sup>Ibid., p. 126.

<sup>8</sup>Bellinger in Memorial, p. 20.

<sup>9</sup>J. R. Howard, Remembrance, pp. 5, 44; Lloyd, Life and Letters, pp. 45, 81, 122; Henry W. B. Howard, ed., The Eagle and Brooklyn: A Record of the Progress of the Brooklyn Daily Eagle . . . Together With the History of the City of Brooklyn (Brooklyn: Brooklyn Daily Eagle, 1893), p. 288.

<sup>10</sup>H. W. B. Howard, The Eagle and Brooklyn, pp. 299-300; Lloyd, Life and Letters, pp. 261-264; J. R. Howard, Remembrance, p. 76.

<sup>11</sup>Bellinger in Memorial, pp. 19-20.

<sup>12</sup>Ibid., p. 20; Lloyd, Life and Letters, pp. 126, 167, 311.

<sup>13</sup>J. R. Howard, Remembrance, pp. 18, 27, 34-35, 73; Joseph P. Howard, ed., Abraham Howard of Marblehead, Massachusetts and His Descendants (New York: Privately printed, 1897), p. 23.

<sup>14</sup>J. R. Howard, Remembrance, pp. 18, 73; Lloyd, Life and Letters, pp. 126-127.

<sup>15</sup>Rickard, ed., Memorial, p. 14; H. W. B. Howard, Eagle and Brooklyn, pp. 298-299.

<sup>16</sup>Lloyd, Life and Letters, p. 129.

<sup>17</sup>J. R. Howard, Remembrance, pp. 43-44, 46, 53-54; National Cyclopedia of American Biography, vol. 19, p. 302.

<sup>18</sup>J. R. Howard, Remembrance, p. 64.

<sup>19</sup>Lloyd, Life and Letters, pp. 27, 336; Bellinger in Memorial, p. 20; J. P. Howard, Abraham Howard, p. 32; J. R. Howard, Remembrance, pp. 36, 50, 54; Mining and Scientific Press (11 October 1919):506.

<sup>20</sup>Bellinger in Memorial, p. 20.

<sup>21</sup>J. R. Howard, Remembrance, pp. 38, 49; Joseph Howard, Jr., Life of Henry Ward Beecher (Philadelphia: Hubbard Brothers, 1887), pp. 58, 74.

<sup>22</sup>H. W. B. Howard, Eagle and Brooklyn, p. 284.

<sup>23</sup>Merle H. Curti, Growth of American Thought, 3rd ed. (New York: Harper and Row, 1964), p. 253.

<sup>24</sup>J. R. Howard, Remembrance, pp. 24, 37, 66; Jessie Benton Fremont, Mother Lode Narratives, ed. and annot. Shirley Sargent (Ashland: Lewis Osborne, 1970), p. 12.

<sup>25</sup>Lloyd, Life and Letters, p. 251; J. R. Howard, Remembrance, pp. 36, 42, 53.

<sup>26</sup>J. R. Howard, Remembrance, pp. 66, 76; Fremont, Mother Lode Narrative, pp. 12-13; Bellinger in Memorial, pp. 20-21.

<sup>27</sup>Rossiter Worthington Raymond in Rossiter Worthington Raymond: 1840-1910, ed. Charles W. Goodale (n.p., 1910), p. 51.

<sup>28</sup>James F. Kemp in Memorial, p. 44.

At the time Raymond attended Heidelberg, Bunsen had already developed his burner and was then engaged in experiments involving its use in spectral analysis, a



procedure which led to the discovery of several previously unknown elements. Kobell, professor of mineralogy at Munich, pioneered new methods of mineral analysis, including his 1855 invention of the stauroscope for the study of the optical qualities of crystals. He was credited with the description of many new minerals.

<sup>29</sup>Engineering and Mining Journal 7 (6 March 1869):152.

<sup>30</sup>Bellinger in Memorial, p. 21.

<sup>31</sup>J. R. Howard, Remembrance, pp. 94, 96-97; Bellinger in Memorial, p. 21.

<sup>32</sup>J. R. Howard, Remembrance, pp. 87-88; Nevins, Fremont, pp. 462-464.

The Hornitas Rebellion resulted from a lawsuit brought by Fremont against the Merced Mining Company. A group of disgruntled miners seized one of Fremont's mines and threatened violence against Fremont and his family. The rebellion ended with the appearance of 500 militia in support of Fremont.

<sup>33</sup>Ibid., pp. 107, 123, 127; Bellinger in Memorial, p. 21.

<sup>34</sup>J. R. Howard, Remembrance, p. 106.

<sup>35</sup>Ibid., pp. 109-110.

<sup>36</sup>Bellinger in Memorial, p. 21.

<sup>37</sup>John Hays Hammond, Autobiography of John Hays Hammond (New York: Farrar and Rinehard, Inc., 1935), pp. 63, 66; Clark C. Spence, Mining Engineers and The American West: The Laceboot Brigade, 1849-1933 (New Haven: Yale University Press, 1970), pp. 30-31; J. C. Bartlett, "American Students of Mining in Germany," Transactions of The American Institute of Mining Engineers (AIME) vol. 5, pp. 434-438; R. W. Raymond, "Biographical Notice of James Duncan Hague," Transactions of the AIME vol. 39, p. 679; Engineering and Mining Journal 82 (21 July 1906):120-121.

These distinguished scientists represent the founding fathers of modern geology and metallurgy. Werner was the first to demonstrate the chronological succession of rock formation, although his theory was flawed by his belief in the aqueous origin of rocks.

Mohs' chief contribution was his work in the area of systemic mineralogy and the development of a scale of hardness that bears his name.

Breithaupt pioneered the study of paragenesis (the regular occurrence of certain minerals in relationship to each

other), a concept vital to the development of economic (mining) geology.

Plattner, a metallurgist, perfected the technique of blowpiping and pursued important studies in the chemistry of smelting.

Von Cotta was one of the first to employ a microscope in examining fossil plants, and later did ground-breaking studies of ore deposits and metamorphism.

<sup>38</sup>Frederick G. Corning, A Student Reverie: An Album of Saxony Days (New York: Privately printed, 1920), pp. 37-38; Spence, Mining Engineers, pp. 31-34.

<sup>39</sup>Spence, Mining Engineers, pp. 31-34.

<sup>40</sup>J. R. Howard, Remembrance, p. 123.

<sup>41</sup>Corning, A Student Reverie, p. 32; Spence, Mining Engineers, pp. 7-20.

<sup>42</sup>Hammond, Autobiography, p. 66; Spence, Mining Engineers, pp. 26-27.

<sup>43</sup>Rossiter Worthington Raymond, Statistics of Mines and Mining in the United States and Territories of the Rocky Mountains: Report of the Commissioner for 1869 (Washington, D.C.: Government Printing Office, 1869), p. 231. Spence, Mining Engineers, p. 24; Corning, Student Reverie, p. 27; Hammond, Autobiography, p. 66; Spence, Mining Engineers, pp. 29-30; American Journal of Mining 5 (1 February 1868):72-73.

<sup>44</sup>J. R. Howard, Remembrance, p. 94; Engineering and Mining Journal 107 (18 January 1919):135; Hammond, Autobiography, p. 65.

<sup>45</sup>Transactions of the AIME vol. 5, pp. 436, 445; R. W. Raymond to Andrew White, 23 January 1906, Fernow Papers, Cornell University, Ithaca, New York.

<sup>46</sup>Hammond, Autobiography, pp. 68-69; Transactions of the AIME vol. 5, pp. 438, 441; Corning, Student Reverie, p. 48; Kemp in Memorial, p. 45; Spence, Mining Engineers, pp. 27, 29.

<sup>47</sup>J. R. Howard, Remembrance, pp. 129, 132.

<sup>48</sup>Engineering and Mining Journal 21 (27 May 1876):509.

<sup>49</sup>J. R. Howard, Remembrance, pp. 123, 130-131.

<sup>50</sup>Ibid., pp. 131, 136; Carleton Mabee, Black Freedom: The Nonviolent Abolitionist (New York: MacMillan and Company, 1970), p. 337.

<sup>51</sup>J. R. Howard, Remembrance, pp. 132-133, 137-138; Bellinger in Memorial, p. 22.

<sup>52</sup>J. R. Howard, Remembrance, pp. 136-138.

<sup>53</sup>Ibid., p. 143.

<sup>54</sup>Ibid., pp. 133, 148; Francis B. Heitman, Historical Register and Directory of the United States Army (Washington, D.C.: Government Printing Office, 1903), pp. 546, 818.

<sup>55</sup>J. R. Howard, Remembrance, p. 140.

<sup>56</sup>Ibid., pp. 154-156, 158.

<sup>57</sup>Allan Nevins, Fremont, Pathmarker of the West, vol. II (New York: Frederick Ungar Publishing Company, 1955), pp. 529-539; J. R. Howard, Remembrance, pp. 171-172; J. P. Howard, Abraham Howard of Marblehead, pp. 31-32; Paxton Hibbin, Henry Ward Beecher: An American Portrait (New York: Doubleday and Company, 1927), p. 183.

<sup>58</sup>J. R. Howard, Remembrance, p. 173.

<sup>59</sup>Ibid., p. 174; Nevins, Fremont, p. 554.

<sup>60</sup>J. R. Howard, Remembrance, pp. 160, 178; Nevins, Fremont, p. 533.

<sup>61</sup>J. R. Howard, Remembrance, pp. 136, 178-180, 187-189; Robert N. Scott, The War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies, series I, vol. 12, pt. I (Washington, D.C.: Government Printing Office, 1880), p. 26.

<sup>62</sup>Nevins, Fremont, pp. 562-563.; J. R. Howard, Remembrance, p. 189.

<sup>63</sup>Ibid., p. 195; New York Times, 1 July 1863, p. 2; Rickard, ed., Memorial, p. 16.

<sup>64</sup>Rickard, ed., Memorial, p. 16; J. R. Howard, Remembrance, p. 210.

## CHAPTER TWO

### "NINE INSIDE":

#### RAYMOND'S TRAVELS IN THE WEST

Occasionally during the fall and winter of 1862-1863, Raymond worked for mining engineer Justus Adelberg, a friend and business associate of John Tasker Howard. The German-born Adelberg was a respected mining consultant, considered particularly knowledgeable about mining in the Far West.<sup>1</sup>

Consulting engineers such as Adelberg were then in great demand. As mine development involved more technical processes, and therefore greater outlays of capital, investors were less willing to trust the opinions of practical mining men, many of whom were speculators and promoters. Eastern capitalists began to insist upon the examination of mines and ores by trained engineers and metallurgists.<sup>2</sup>

Unfortunately for Adelberg, the growing demands of his consulting practice coincided with his own increasing physical debility. He suffered recurrent illnesses and nearly continuous attacks of pain, the result of inhaling mercuric vapors in a laboratory mishap in 1860. It was apparently this combination of business commitments and failing health that

led Adelberg to offer a junior partnership to Raymond in early 1863.<sup>3</sup>

The partnership was a rare opportunity for a young engineer. By his own admission, Raymond had "nothing but my education at Freiberg and service (occasionally in the line of engineering) in the Union Army to qualify me for serious professional work."<sup>4</sup> In spite of the demand for trained engineers, young mining school graduates found it difficult to establish themselves in the profession. Lacking the experience and reputations that attracted consulting work, few could support themselves as independent experts. Mine owners were reluctant to entrust the evaluation of their property to unknown engineers. Most mining engineers began their careers as assayers or surveyors, working their way up to mine or mill superintendency, then to operations management. In this way they acquired enough experience to gain acceptance as examining consultants. Unfortunately, the process might consume most of a man's career. Moreover, it meant long absences from home, the semi-nomadic existence of life in the field or, at best, residence with one's family in a succession of dreary company towns or isolated mining camps. Although eager for such practical experience, Raymond probably did not find the prospect of such a lifestyle attractive, particularly in view of his recent Army experience. Moreover, in March 1863, he had married Sarah Mellen Dwight, who, like himself was a member of an old, established Brooklyn family. The

partnership with Adelberg meant that Raymond would have stable employment in his profession and could maintain his family home in Brooklyn.<sup>5</sup>

Adelberg & Raymond, Consulting Mining Engineers and Metallurgists, Offices at 90 Broadway, New York City, offered expertise in nearly all aspects of mineral production, whether in metals, coal, or the new source of excitement, oil. In addition to the two partners, the firm employed a number of young engineers as assistants. Mostly Germans, these men also benefitted from their association with Adelberg. Said Raymond, it "carried them to some extent over that period of acclimation which was in those days often disagreeable and sometimes disastrous to foreign experts in this country." Several of them subsequently made distinguished contributions to the mining industry: Charles A. Stetfeldt, Herman Credner, Otto H. Hahn and, of particular importance to Raymond's career, Anton Eilers.<sup>6</sup>

As junior partner, Raymond's role was largely editorial, supervising the assistants, editing their reports and writing his own reports based on their field-notes. Through these duties, and through daily association with his experienced partner, Raymond learned the difficulties of mine examination and the practical aspects of the mining business. It was a valuable education in which he adjusted the scientific and engineering theories of Freiberg to the realities of American mining. Nonetheless, Raymond was keenly

aware that there was no substitute for actual experience, and lamented the fact that his work kept him at the firm's Manhattan office with "only occasional opportunity for fieldwork." His rare examining assignments were limited to familiar Eastern districts at the very time Western mining was alive with the excitement of exploration, discovery and development.<sup>7</sup>

In spite of Raymond's impatience with the sedentary nature of his work, the partnership was harmonious and profitable. As Adelberg's health deteriorated, Raymond assumed a larger share of the practice. When Adelberg died in 1869, Raymond remembered him as "my wise, kind teacher, my upright partner, my dear, true friend." Ironically, he wrote those words not in the firm's comfortable office on Broadway, but as he sat "alone by midnight in a strange city"--Central City, Colorado--no longer an office-bound consultant, but among the most widely-traveled mining engineers in the West.<sup>8</sup>

Raymond's education at Freiberg and his early experience with Adelberg had equipped him with the theoretical knowledge and practical experience necessary for a successful career as a consulting engineer. However, it was his association with the Engineering and Mining Journal that brought him to the attention of the industry and the public at large.

The Journal was originally published as The American Journal of Mining, a weekly tradepaper published by former

prospector and artist Charles Callis Western. Western had been unsuccessful in a previous publishing venture in San Francisco during the 1850s, but his experience in the California mining camps had convinced him of a lucrative market for the advertising of mining equipment. To capitalize on this, Western formed a partnership with his brother Benjamin, an advertising agent, and founded the Journal in 1866.<sup>9</sup>

During the same year, at Adelberg's urging, Raymond wrote an English translation of the introduction to Bernhard von Cotta's Die Geologie der Gegenwart. He contributed the piece to the Journal, partly to assist the fledgling publication and partly to advertise the firm of Adelberg & Raymond, Mining Consultants. Charles Western was so impressed with the clarity of Raymond's writing that he immediately recruited the young engineer to provide anonymous editorial material. After the resignation of editor George F. Dawson in early 1867, Western offered Raymond the position. Raymond was reluctant, fearing that the responsibility of editorship would interfere with his consulting duties, particularly with his opportunity for field work. Nevertheless, he finally accepted. On July 13, 1867, Raymond officially became Editor-in-Chief of The American Journal of Mining, beginning an association that lasted until his death in 1919.<sup>10</sup>

Raymond brought a sense of mission to the editor's chair, particularly with regard to the role of mining in the



West. Like other European-trained mining engineers, he saw mining not only as an industry essential to the national economy, but also historically as the chief agent of civilization. Without the products of mines he wrote, ". . . there could be no civilisation and men would only exist as savages."<sup>11</sup> The American mining frontier, then, was an opportunity to participate in the advance of civilization. Raymond made it the Journal's purpose to assist in the civilizing of the continent by introducing sound scientific theory and technological concepts to the haphazard, often wasteful conduct of American mining. Editorial assistant Willard Ward summarized Raymond's goals:

. . . to stimulate the intellectuals of the wild and woolly Western miner, and to let him know that in his rapid advance in overcoming natural obstacles he had the aid and good wishes of professional men, who were elucidating new processes and explaining as best they could, the geological questions which they presented practically to the man with pick and drill.<sup>12</sup>

The task of appealing to the so-called "practical mining man" was not an easy one. In spite of investors' increasing demand for the involvement of educated engineers in mine examination and operation, the industry remained dominated by men who believed that successful mining depended on luck, experience and hard work. These men doubted the applicability of "European" theories to American ores, and scoffed at university-trained geologists who were ignorant of the realities of the mining business.<sup>13</sup>

To win a following for the Journal among these men, Raymond had to present geological and metallurgical sciences in a manner understandable, practical and attractive to them. The result was a publication that reached beyond scientific and technical content. Reflecting his own literary interests, Raymond expanded the Journal's scope by including non-mining book reviews, poetry, humor and cultural features, and increased its coverage of national and international mining news. He combined engineering expertise with an entertaining and literate writing style, upgrading the paper's technical quality while enhancing its appeal to non-professional readers.

By the end of 1867, Raymond's efforts were largely successful. The Journal had the largest circulation of any American mining periodical and had earned praise both in the United States and Europe.<sup>14</sup> Raymond wrote with pride:

Probably no other paper in the country is more broadly scattered through every part of the national domain. In the far mining districts of the West and South . . . such a journal is not hastily perused and cast aside, but studied and circulated sometimes until, after passing from camp to camp and cabin to cabin, its tattered pages no longer hang together.<sup>15</sup>

Still, Raymond himself lacked any first-hand knowledge of the West. That he believed such experience was important to his role as a mining editor, as well as an engineer, was clear in one of his earliest book reviews. Writing a review of fellow editor O. J. Hollister's The Mines of Colorado, Raymond praised it precisely because it was the result of experience

rather than the mere compilation of facts, "not the work of scissors alone, but of pen." Said Raymond of Hollister:

. . . he has made use of his experience as an editor, his acquaintance with men and things in Colorado, his powers of observation and description, in the production of a book which is not merely a catalogue, but a picture.

It was this personal observation that enabled one to "separate truth from falsehood, and treasure from rubbish."<sup>16</sup>

Nor was Raymond's desire for "experience" a strictly practical matter. The 27-year-old Raymond found himself writing of the achievements of his contemporaries, men like J. D. Whitney, Clarence King, and James D. Hague.<sup>17</sup> Although successful and secure, Raymond still harbored a desire for adventure and an envy of those who were going and doing. One senses this in his announcement of the safe return of his friends Raphael Pumpelly and Hermann Credner from "long and arduous explorations in the forests of the upper Peninsula of Michigan. . . . They have stirring tales to tell of their life in the woods," Raymond told his readers, before adding, "and we believe they have accomplished as much in the way of science as adventure."<sup>18</sup>

Although confined to his New York office, Raymond's editorial opinions frequently ranged Westward during his first year as editor. The first forty issues of the paper contained nearly fifty editorials dealing with various issues affecting mining in the West. Recurring topics included federal Indian policy, the progress of the Union Pacific Railroad, the morass

of Western mine litigation, the need to continue the California Geological Survey, and a variety of technical problems involving the reduction of Western ores. Ironically, however, it was a series of editorials on a topic of only passing importance that brought Raymond the opportunity to take his place among his fellow engineers in the West.

In 1867, Senator William M. Stewart of Nevada introduced a bill for the establishment of a national school of mines, similar to the government-directed and subsidized mining schools in Europe. Mining education in the United States was stagnant, the only major advance occurring with the establishment of the Columbia School of Mines in 1864. Most Americans who wished to study mining still had to go abroad. Stewart's measure found ready support from Raymond, who took up the cause in a series of lengthy editorials in the winter of 1867-1868. His arguments for the school were couched within a larger examination of the role of mining and the government's relationship to the industry. Although Raymond's efforts on behalf of the school were in vain (the bill never was reported out of the Committee on Mines and Mining), the editorials brought him to the attention of Senator Stewart and other Western legislators.<sup>19</sup>

The idea for the school of mines had originated with the United States Commissioner of Mining Statistics, J. Ross Browne. Browne was about to resign to accept the post of U.S. Minister to China. He was one of several prominent

Californians who had lobbied for the creation of the mining commissioner in 1866 "to inaugurate a systematic inquiry into the state and requirements of the mining interests" in the West in response to a national decline in bullion production. During Browne's two-year tenure, he had traveled among mining districts in California, Nevada, and Arizona, compiling two large volumes of statistical information.<sup>20</sup> Unfortunately, Browne's reports were met with sharp criticism from both professional and practical mining men. Many districts felt slighted by his coverage. One frontier editor growled that Browne had "gone through" his district "like a dose of the salts." Another complained that his district had received only ten lines' notice in the commissioner's report, and urged that "a less biased man" be selected to make "a fair report." Browne also met with criticism from the scientific community. A journalist by trade, Browne had no formal training in mining or mineral sciences, and was perhaps best known as a writer of humorous essays. Writing in advance of the publication of Browne's second report in 1867, Raymond was among his harshest critics:

Better than the first report it will be, because it couldn't be worse. . . . the most important parts of the work have been put into incompetent hands. . . . Mr. Browne himself is a rapid traveler and superficial observer by nature and education. He is the first instance we can recall of a "funny man" raised to the head of a great scientific work.<sup>21</sup>

Nonetheless, Browne's second report was an improvement over the first, and Raymond quickly rose to its defense. When

Browne's China appointment was announced in March 1868, Raymond expressed genuine regret at Browne's departure from the commissioner's post. He praised Browne's willingness to learn from criticism, and his earnest efforts in confronting his task. The flaws in Browne's earlier work Raymond now believed were the result of "all the disadvantages of his own inexperience." Browne's final report, he wrote, "not only presented a picture of our mining enterprise" but also reflected "a just appreciation of their bearing upon our future prosperity."<sup>22</sup>

The selection of Browne's successor incited political maneuvering by various interested parties. Unhappy with Browne's lack of formal education in mine matters, the professional or "scientific" mining lobby demanded that the new commissioner be a trained geologist or engineer. At the same time Western congressional delegates insisted that the appointee be acceptable to the "practical" men who controlled the mining industry. Mining engineer William P. Blake received strong support, but he had incurred the enmity of Nevada's Senator William Stewart by an unfavorable mine report some years earlier. In the end, Senator Stewart and Senator James W. Nye, also of Nevada, won the appointment for Raymond. Although some critics later charged that Raymond gained the post through influential friends (his uncle I. W. Raymond did have strong political connections), Raymond always maintained,

even to close friends that the appointment was a surprise to him.<sup>23</sup>

For Raymond, the Commissioner's appointment represented the best possible opportunity for field work, writing and traveling in the West. He could perform his official duties during the summer, while continuing his consulting and editorial work in New York the rest of the year.

His assignment was essentially the same as his predecessor's. He was to examine the problems of the Western mining industry (particularly those related to declining production), recommend the role government should play in assisting the industry, and study the feasibility of the not-yet-dead national school of mines.<sup>24</sup>

Shortly after his appointment, Raymond wrote a Journal editorial on the California Geologic Survey. He had been a stalwart defender of the survey, repeatedly denouncing the California Legislature's decision to end funding of the work before its results could be published. But in this editorial, Raymond himself criticized J. D. Whitney for his handling of the survey's results. In Raymond's criticism of Whitney may be seen the goals the new mining commissioner had set for himself.

According to Raymond, the downfall of the California survey occurred because the results "were not adequate to the money and time expended on it, and . . . they were not brought

before the public in practical and useful form" while the work was in progress. Raymond sympathized with the struggling mining communities seeking useful information. He believed such data was already within the survey's grasp, but thought that the survey's "body of distinguished professional men . . . busies itself almost exclusively with laying a broad and thorough scientific basis for a magnificent examination of the State, and tells [miners] to wait a few years . . ." The miners, he wrote, "ask for a roof over their heads, and are pointed to the slowly rising foundations of a mighty edifice."<sup>25</sup>

Raymond did not question the ultimate value of the California survey results, only the fact that no provision was made to serve the public with useful information while pursuing the survey's "elaborate scientific work." Raymond pointed to the New York survey, which had periodically published volumes of such relevant material. He concluded, "Scientific men must remember that they have to deal with the prejudices and ignorance not only, but also the legitimate demands, and immediate necessities of the people." Clearly, Raymond intended his own work to be useful, and his results to be timely.<sup>26</sup>

Raymond wasted no time in taking up his commissioner's duties. Rather than wait on the slow progress of a new appropriation (stalled in Congress by presidential impeachment proceedings), Raymond decided to begin work immediately, using



funds remaining from the previous year's appropriation. Leaving the Journal in the hands of his editorial assistants, Raymond sailed for San Francisco aboard the side-wheeler Henry Chauncey, departing New York on May 9, 1868.<sup>27</sup>

In mid-May, while still at sea, Raymond wrote the first of a remarkable series of letters narrating his travels as mining commissioner. Published in the Journal as "Editorial Correspondence," the letters contained not only professional observation and editorial opinion, but also personal, highly descriptive accounts of his experiences. Raymond clearly welcomed the opportunity to indulge his creative writing, as he informed his editorial staff:

If . . . you fondly suppose, O gentlemen left in charge . . . that the frisky Editor-in-Chief will furnish you with valuable information or wise advice every time . . . let this first epistle undeceive you. If anything useful finds its way into these pages, it will be sorely against his will.<sup>28</sup>

Although that initial letter was a bland account of shipboard life, by the time Raymond crossed the Isthmus, his letters had assumed a dual literary and scientific focus that reflected the author's own twin perspectives on his travels. The letter that began at Colon with vivid images of "shining, half-naked negro porters" and "stately Creole women, with . . . chemises slipping from their polished shoulders," ended on the Pacific shore with an engineer's view of the city of

Panama: streets "narrow, but clean," good drainage, and "an excellent sewer in process of construction."<sup>29</sup>

However, upon his arrival at San Francisco on the evening of May 30, Raymond's concerns were primarily and immediately scientific. In less than twenty-four hours, he stood before the California Academy of Sciences, explaining his "mission, motives and intentions." He stressed that as commissioner he was there not to instruct, but to learn. Remembering the charges of bias leveled at his predecessor, he promised "to do impartial injustice to all." He approached the feud between scientists and practical men with similar light humor: "There is a class that superstitiously venerate anybody who has the smell of a German college on his garments, and another with whom to be called a scientist is to be pronounced a humbug." Raymond stated his belief that Californians' sense of fair play would see to it that "real merit in science and in practical business" would eventually win out. Reminding both camps of their common problem in Washington, D.C., Raymond asserted that it was his role to assist them by presenting "plain facts and practical suggestions to legislators ignorant of the whole subject of mines and mining."<sup>30</sup>

Raymond's diplomacy and humor apparently carried the day. Even the Journal's West Coast rival, the Mining and Scientific Press, expressed its approval of the new commissioner:

His affable manner will doubtless disabuse many an honest miner of the notion that "Freibergerers" are all conceited and arrogant positivists, who hold in contempt the ideas of "practical men".<sup>31</sup>

Raymond's first week in the West was spent meeting with the mining capitalists of San Francisco, and sightseeing, probably with his uncle Israel. When he found time to resume his editorial correspondence, engineering matters took priority. His initial letter was a technical description of "dynamid" blasting. The next letter, however, was devoted entirely to Raymond's personal observations of the city.<sup>32</sup>

Raymond's first attempt to write as an eyewitness in the West was an extremely "tongue-in-cheek" treatment of San Francisco. Aside from a description of the Golden Gate at sunset, he paid relatively little attention to the city's natural scenery, although its "beautiful, bare hills" were "fine natural symbols of what artists call 'the nude'." He made repeated references to the city's dust (" . . . drifts along sidewalks and fences like snow in a New England winter") while steadfastly denying that it caused any discomfort. He avoided any unfavorable comparison to Eastern cities, but noted that San Francisco's buildings were "in general very low," adding ". . . the big earthquake a couple of years ago caused low wooden buildings to be fashionable, but . . . the effect of that panic is somewhat abated, and many new blocks are three stories high." The fact that the city was "peculiarly liable to conflagrations" was mitigated by its

"thoroughly efficient fire department." Drinking was common ("we might say almost universal") but intoxication was "less frequent" than in the East. This he attributed to "the climate, the active out-door life of the people, and the great consumption of claret and light wines."

The most significant feature of this letter, however, was his discussion of two controversial topics: Chinese labor and miners' unions. After a week in which he had seen Chinese "everywhere," Raymond defended them as "docile, dextrous and faithful workers . . . most peaceable and industrious members of society." He decried legislation against them stating "all decent men are disposed to protect them in their rights." Obviously not included among "decent men," in Raymond's view, were those miners, specifically "American, Cornishmen, or Irishmen" who opposed the Chinese because they feared the competition of cheap labor. Raymond had no sympathy for them and left little doubt of his anti-labor bias when he wrote, "the miners have been calling for years for the assistance of capital, and if they receive that boon, they must take the consequences along with it. Capital will look for labor where it can get it most advantageously . . ." Raymond's views were clearly unsympathetic to organized labor. He believed Western miners' wages were too high in relation to the cost of living, and constituted the major obstacle to rescuing the industry from speculation and placing it on a sound business footing. In his opinion (one shared by most of his profession), miners

only hurt themselves by opposing the introduction of cheap labor, for they were hindering their industry's expansion and with it, their own chance for individual advancement.<sup>33</sup>

Such discussions became characteristic of Raymond's editorial correspondence. Almost invariably after their initial appearance here, serious topics would receive lengthier treatment later on the Journal's editorial pages.

Raymond spent the next several weeks visiting mining districts in California and Nevada. Major stops on his California tour were the New Almaden quicksilver mines, the Mariposa estate, and the Grass Valley mines. The major portion of the correspondence written in this area concerned mine management and technical questions, revealing little of his reactions to the West. Raymond explained the traveler's failure to write a narrative, "Time and events invariably got the better of him, and his perspiring pen lags hopelessly behind." But it also may have been due to the fact that he was visiting well-established districts, a part of the West already settled and well-known. This was hardly adventure, or even "life in the field":

The moment a mining camp . . . can support anything more than a shanty, it advances with a spring to the first rate St. Charles . . . or other ambitious title. Billiard-tables appear on almost inaccessible heights, and choice French wines flow amid the snows of the Sierra.<sup>34</sup>

That Raymond sought adventure in the wilder places of the West was obvious when he visited Yosemite in late June.

The experience unleashed his pen in happy descriptions of "much rough riding and climbing," of "snow on the trail to wallow in, and torrents to ford, and huge fallen trees to surmount . . .", and stream-crossings that "invariably terminated in a ducking." He wrote of lying awake at night listening to the thunder of Yosemite Falls, watching "its white column, wreathed with smoke, by the light of the full moon." Raymond was overwhelmed by the valley's grandeur and, like other tourists, described its scenes to excess.<sup>35</sup>

Raymond's uncle, Israel Ward Raymond, had played a major role in the preservation of the valley and the Mariposa Big Trees in 1864. It was I. W. Raymond who, in a letter to California Senator John Conness, first proposed that the valley be set aside "inalienable forever" as a "place of public use, resort and recreation."<sup>36</sup> Perhaps his uncle's words were on his mind as Raymond viewed the Yosemite Valley and considered the implication of his chosen profession for such a place. He was not oblivious to the damage wrought by mining. He had, he admitted, observed "how ruthlessly throughout this land, the bold 'prospector' has torn open the breast of Earth . . . undermined mountains, wrested rivers from their course, and laid many a fair acre bottom upwards . . ." Nonetheless, like most engineers of his time, Raymond valued utility over aesthetics. It was fortunate, he wrote, that "Nature does not always make her things of beauty things of use; they might else cease to be joys forever . . ."

Yosemite remained unspoiled because its splendor was barren of exploitable minerals.<sup>37</sup>

Raymond left California for the Nevada mining districts in mid-July. There he spent the next month examining mines on what he clearly regarded as the frontier. Writing soon after his arrival in Virginia City, he described his experiences at Tahoe City ("a hotel, a saloon, a store, a barn, and a liberty pole.") He slept on the floor of the Tahoe House and, after encountering a stage-driver who refused to start for the railhead at the scheduled hour, Raymond had to walk the fourteen miles to the station. Nonetheless, from the variety of his observations and the enthusiasm of his descriptions, it appeared that he relished such hardships.<sup>38</sup>

Raymond's final letter from his first journey West seemed to bear out the fact that it had been, as he hoped, as much adventure as it was scientific mission. In a lengthy account of his trek to a remote mining district, Raymond delighted in re-living the events of his journey: "galloping wildly over the sage-brush upon our gallant little steed," visiting "uncouth little cabins," soaking in a steaming hot-spring, and winding through steep side canons ("little Yosemite, every one.") Finally, after a twenty-five-hundred foot climb (" . . . the wildest of all"), he arrived at his destination: "a busy town, a clattering mill, and a real mine."<sup>39</sup>

Raymond concluded his tour of the West in late September, returning home to New York via the Central Pacific and Union Pacific Railroads. He had traveled some 13,000 miles in four-and-a-half months.<sup>40</sup>

Back in New York, while resuming the editing of the Journal and tending to Adelberg & Raymond business, the mining commissioner began preparation of his report to Congress. Friend and fellow mining engineer George W. Maynard described what became an annual ritual for Raymond:

During the winter nights he would retreat to the den (unheated in order to keep his brain cool) in the garret of his house; wrap a blanket around his feet and legs, and burn the midnight oil . . .<sup>41</sup>

According to Maynard, the composition of the annual report was the most difficult part of Raymond's job. Raymond was determined that his report would be descriptive as well as informative. In his view, most government documents were regarded by the public as "dry and stupid things, only fit to lie on the tables of country taverns" and therefore much valuable information (collected at public expense) went unused. He strove for a well-written, accurate portrait of Western mining.<sup>42</sup>

Raymond submitted his report to Congress on January 16, 1869. It included an assessment of the current state of the Western mining industry, the Commissioner's recommendations for government assistance to the industry, his observations on the districts examined during his tour, and,



of course, statistical tables. Perhaps remembering Ross Browne's experience, Raymond awaited his critics, expecting that the report would be "satisfactory to nobody, but suggestive to everybody."<sup>43</sup>

Western reaction to the report was mixed. There were many favorable reviews, like that of the Alta California, whose editor predicted that Raymond's report "will be prized far more than Government documents usually are." However, from districts not visited by the commissioner, or represented by statistics they doubted, attacks on the report and its author were sharp. Raymond responded by stressing the preliminary nature of the first report and the size of the commissioner's task. It was absurd, he wrote, to expect "a single man, without organized aid, to wander over the vast Pacific slope, picking up statistics like a hen picking up corn in a barnyard."<sup>44</sup>

Eastern response to the report was positive and came from widely diverse sources. The literary magazine Round Table admired Raymond's writing for "its bold, businesslike style," while the New York Stockholder had good words for the commissioner personally. Raymond, said the Stockholder, was a man of "good intellect" with appropriate experience for his position, who above all, had "a sturdy regard for the truth, the indispensable element in character which makes a man really valuable."<sup>45</sup>

Raymond's later reports, 1869-1876, generally followed the pattern established in the first. Each was divided into three parts: I, a report on the current conditions in Western mining; II, treatises on technical developments in mining and metallurgy; and III, "Miscellaneous," essays on various topics affecting the mining industry, such as mining law, gold and silver values, and international coinage.

While the technical and miscellaneous papers were important to the mining industry, Raymond himself believed that his reports' lasting value was due to the detailed description of Western mines and districts presented in the first part of each report: ". . . the whole series represents a reasonably complete exhibit of the mining districts, and the progress of their development."<sup>46</sup>

Part I contained the bulk of Raymond's statistical information. Organized by state or territory, county, and mining district, the accuracy of the figures depended upon the cooperation of the mining industry. As commissioner, Raymond had no authority to demand access to mines or records. His mine examinations were entirely at the discretion of mineowners and superintendents. That Raymond did not always receive the cooperation, or sometimes distrusted the information supplied by mine operators was evident. It was, he observed, "the nature of the industry itself and the motives which influence the minds of those engaged in it to withhold from publication the full and true account of its

results." For this reason, Raymond collected and compared statistics from a variety of sources before compiling his final estimates. Consulting engineers, county assayers, Wells Fargo agents, and newspaper editors were among those who shared their information with the mining commissioner.<sup>47</sup>

However, Raymond was hardly content to let numbers tell the story of the mining West. In addition to statistical tables, this part of the report contained lengthy descriptions of districts' climate, topography, scenery, timber and water resources, mine structures, and agricultural potential. These descriptions were often as colorful as they were detailed, whether Raymond was describing the beauty of Utah's Big Cottonwood Canyon (" . . . the stains and patches of brilliant color from . . . wildflowers that cover . . . the mountainside with pure white, and delicate blue, and bright yellow, and fiery red . . .") or the somber atmosphere of a mining camp "gone bust" ("Hamilton . . . was painfully quiet. No crowds congregated in its streets; the merchants were selling out at great sacrifice. . . . The houses were even disappearing . . ."). Indian activity, a matter of concern to miners, was another topic discussed in Part I. Usually, coverage pertained to hostilities in the mining regions, or brief sketches of tribes in a particular area, based on contributors' information. Occasionally, however, Raymond wrote of his own experiences, which were generally chance encounters with peaceful tribes such as the Salish fishermen

on the Columbia River, or a lone Pueblo in an ancient turquoise quarry.<sup>48</sup>

While Raymond's first report was almost exclusively the result of his own efforts, the later volumes represented progressively more extensive compilation from other sources. The gathering of statistics and reporting on local conditions was delegated to resident agents wherever possible. Raymond also solicited contributions from prominent mining men throughout the West. The contents of the technical and metallurgical chapters were frequently reprinted from other government documents and trade journals. Possibly this was Raymond's way of ensuring that worthwhile material received as wide a circulation as possible. Contributed material increased especially after 1873. That year Raymond, president of the American Institute of Mining Engineers (AIME), urged members to select for their AIME contributions "subjects suitable for publication in my reports to the Government, as presenting much needed information concerning details of American practice." Raymond himself often relied verbatim et uteratum on his Journal editorials of editorial correspondence for portions of the text.<sup>49</sup>

The increasing amount of contributed material notwithstanding, Raymond's skill at composing and editing was manifest. He avoided the "patchwork effect" for which he condemned so many other government reports. Indeed, it was characteristic of his editing, that without careful reading,

it was often difficult to distinguish Raymond's own original prose from the edited copy of a contributor. The reports were praised at home and abroad, wrote mining engineer Walter R. Ingalls in 1919, "for the beauty of their style, their language always clear, incisive and easily flowing; the accuracy of the descriptions, the keenness of the perception . . ." He concluded, "No other country possesses such a chronicle of the development of its mining industry, and we may rightly esteem these volumes as classics of mining literature."<sup>50</sup>

Between 1869 and 1875, Raymond made six more journeys West, describing each to some extent in "Editorial Correspondence." When a critic denounced the "triviality" of his travel narratives, Raymond responded that the "fatigues of staging above ground, and climbing, crawling and dangling underground" often left him without the time or energy for consideration of serious technical matters in his correspondence. He continued his descriptive accounts, admitting that they were "good, bad or indifferent, according to the state of the roads, the quality of the meals, and the number of hours of sweet balmy what-d'ye call it . . ."<sup>51</sup>

Of Raymond's six inspection tours, those in 1869 and 1871 were of particular interest, for he regarded them as personal adventures as well as professional missions.

Raymond's second trip, in 1869, was his most extensive; he visited Colorado, Utah, Nevada, California,

Oregon, Washington, and Idaho within the span of four months. His original plans included Montana as well. The grueling itinerary may have been, in part, a response to critics of his first report, but more likely it was a reflection of Raymond's own desire to see as much of the West as possible. It is also possible that his own sense of adventure had been whetted by seeing his younger brother Charles embark that spring on a military exploration of the Yukon.<sup>52</sup>

In any event, Raymond was clearly delighted to be returning to the West. On a Pullman palace car near Omaha in early June, he wrote, "Out here on the prairies, everything is fresh and free; no tradition or precedent hampers the energy of the people." His own energy was evident as he shared with his readers the excitement of his ride on the Union Pacific engine "America" ("the most magnificent engine on the continent") as it maintained a speed of 50 miles per hour over the plains.<sup>53</sup>

Raymond spent much of June in Colorado. The majority of the territory's mines were on the eastern fringe of the Rockies, and therefore outside the mining commissioner's jurisdiction. However, Raymond voluntarily included them in his itinerary, since there was no appropriation for another mining commissioner to collect statistics for the Eastern Slope.<sup>54</sup> As he had done the previous year in California, Raymond began his tour by addressing the region's prominent mining men, in this case, at the Denver Board of Trade.

Exactly what Raymond said at the Board of Trade went unrecorded, but it was clear from his "Editorial Correspondence" that he intended to be far more outspoken in his views of Colorado than he had been about California the previous summer. Stating that greed in the form of reckless speculation and endless litigation had blighted the growth of mining in Colorado, he promised Journal readers that they would hear more on the subject, "for it is high time the whole truth were spoken, and, if there is gall in ink, I will make it 'unpleasant' enough to be heard."<sup>55</sup>

In July, Raymond traveled to Utah. He was impressed by the irrigation system and flourishing gardens and orchards at Salt Lake City, but it remained to him "a city of ignorant fanaticism." Like most Americans of his time, Raymond regarded the Mormon Church as anti-Christian and un-American, views largely engendered by the Church's practice of polygamy and defiance of federal authority. No doubt the Mormons' brand of enforced communalism was also repugnant to Raymond. As a devoted follower of Henry Ward Beecher, Raymond adhered to a conservative social and economic doctrine that stressed the sanctity of private property and held that inequalities resulting from laissez faire capitalism were the expression of God's will. Even more disturbing to Raymond, however, was opposition of Mormon leaders to the development of the mining industry in Utah. During an earlier visit to Salt Lake City, Raymond had discussed the matter with Church president Brigham

Young. Young denied that he entertained any hostility to mining. He discouraged Church members from engaging in mining activities only because he believed agriculture was far more profitable. Young also insisted that the Church was not opposed to non-Mormons pursuing Utah's mineral wealth: "What we used to call lead and dig and melt up into bullets, these fellows call silver now! But if anybody is fool enough to come and mine for it, he may do so, and welcome!"<sup>56</sup>

While in Salt Lake City, Raymond called on the nearby headquarters camp of Clarence King, director of the Geological Survey of the Fortieth Parallel. It was the scientists' first meeting, and Raymond, already an admirer of King's, liked him immediately. After dinner the two men, lounging on a pile of skins and blankets, "chatted scientific small-talk, and politics, and exchanged views, as travellers away from home always do. . . ." Raymond was amazed at the "decencies and elegancies of city life" that attended King's life in the field. Indeed, his host was dressed in "immaculate linen, silk stockings, low shoes, and clothing without a wrinkle." When Raymond expressed his surprise, King reminded him, curtly perhaps, that unlike most mining engineers, the mining commissioner was only a seasonal visitor to the West. Years later Raymond could still recall King's words:

It is all very well for you, who lead a civilized life nine or ten months in the year, and only get into the field for a few weeks at a time, to let yourself down to the pioneer-level, and disregard the small elegancies of dress and manners, which you can afterward easily resume, because you have not laid



them aside long enough to forget them. But I, who have been for years constantly in the field, would have lost my good habits altogether if I had not taken every possible opportunity to practice them.<sup>57</sup>

Nor did Raymond dispute King's view. He readily admitted that "Gallop[ing] over the sagebrush on a spirited horse, in glorious summer weather, and in good company, is a very different thing from living in the sagebrush with no company at all."<sup>58</sup> This initial meeting in the Wasatch Mountains grew into a lasting mutual admiration. Later King would find Raymond a firm--and powerful--political ally during the struggle for control of the national surveys in the late 1870s.<sup>59</sup>

From Utah, Raymond traveled through numerous Nevada and California mining camps, arriving in San Francisco in mid-July. From there he began a long stagecoach journey through California to Oregon. En route, he made a side-trip to view the "Geysers" near Calistoga, penning two lengthy letters about his experience. After the hectic pace of a trip crowded with "almanacs and clocks and hotel bills and business elsewhere and stern official duty," Raymond found his secluded cottage at the Calistoga hotel a welcome retreat. From his veranda he admired the "flourishing harmony" of pine and palm trees, and wondered at the balmy California air that combined "the stimulant coolness of the North and the spicy languor of the South. . . ." He supposed that in other places the cottage-style lodgings "might be . . . a little defective in the means of communicating with waiters and messengers . . .",

but in such a place as Calistoga, he decided, "you do not want anything, except to be left to your sweet peace and comfort."<sup>60</sup>

The stage ride to the Geysers was quite a different matter. Raymond described in detail the skill of the driver "Old Foss" who declared, "it's all dam nonsense, driving downhill slow; it ain't safe!" and then proceeded to drive the narrow mountain road at a gallop, with lead horses rounding sharp curves at the edge of a precipice and axles scraping the inside wall. Raymond admitted to being "first dizzy, then scared," but found the ride an exhilarating experience--"good old-fashioned California stage-driving such as used to wake the echoes on the Donner Lake and Placerville roads!"<sup>61</sup>

Safely arrived at the Geysers, however, the scientist took over from the adventurer. Raymond observed that the variety and appearance of the hot springs were likely to astonish the unscientific observer, "but it is easily explained by the chemist . . ." And the "chemist" proceeded to do so at length, concluding: "the Geysers afford an admirable illustration of the metamorphosis of rocks by solfataric and thermalaqueous action, and the transposition and deposition of mineral salts."<sup>62</sup>

The stage-ride north through California was a long one ("six days and a half, travelling almost constantly day and night.") Possibly Raymond chose the overland route instead of the coast steamer because of the mining camps along the

way, and also because of the scenery. Unfortunately, he was disappointed. He wrote, "In sober fact, many miles of mountains to the northward being on fire, the air was filled with smoke; and I went within thirty miles of Shasta without seeing it." The experience was not lost on Raymond. Although he had previously commented indirectly on the need to curb the rampant waste of timber resources, the sight of burning forests convinced him of the need to address the problem directly:

Anyone can see Shasta at anytime; but if the woods are allowed to get afire a few more times, as they are now in Washington and Oregon, a burning forest will become a thing of the past. So I enjoyed the splendid spectacle with a due sense of its perishable nature. Much is said, and more should be done, with regard to the great loss of valuable timber from these fires. I have an article a-brewing on that theme.<sup>63</sup>

In spite of the smoke, Raymond was impressed by his first look at Oregon. The deciduous trees, snake fences, and farm fields of the Rogue and Willamette Valleys reminded Raymond of his native New York State. He found the lush foliage and humid climate a welcome relief from California. That state, he wrote, was like "your amber blonde, passionate proud and slightly mysterious." Oregon, on the other hand, was a "sweet, steady-going, charming and easily comprehensible domestic beauty . . ."<sup>64</sup>

In mid-August, Raymond embarked on a steamboat for the journey up the Columbia. Here, too, smoke shrouded the mountain scenery ("only the immediate banks of the river were

visible from the steamer.") At the Dalles, he made a three-day side-trip to an "ice-mine" near the foot of Mt. Adams. He enjoyed the rare opportunity to "rough it," but omitted the experience from his letter, saying that "the charm of woodcraft, camp-fire, chinook jargon, and clear mountain lakes and streams, is one which evaporates from ordinary ink." Raymond did describe his expedition into the mine, a year-round ice deposit in a lava tube.

The ice is of beautiful transparency. Stalagmites are more common than stalactites, or ordinary icicles, in the cave. The largest body of ice lies level, like a frozen pool, in the bottom, but here and there it rises into mounds and spires of the clearest crystal. One of these, called "The Iceberg" rises nearly to the top of the cavern. We climbed over it, cutting footsteps in its smooth surface with a hatchet, and illuminated it gloriously from behind with our candles.

From the ice-cave, Raymond made "a short day's ride" to the snowline on Mt. Adams where he found a "wilderness of flowers, embracing in dwarfed forms of great delicacy and beauty, almost the whole flora of the coast, and peopled with innumerable hummingbirds . . ." The entire excursion was, he said, "a delightful thing."<sup>65</sup>

Late August and early September found Raymond concluding his tour with inspections of mining camps in eastern Oregon and Idaho. He returned home via the Union Pacific in late September.<sup>66</sup>

In 1870, the mining commissioner's appropriation was again stalled in Congress. This, along with a delay in

printing his 1869 report, prevented Raymond from reaching the field until late September. While his assistant Anton Eilers toured Arizona, then in the throes of Indian warfare, Raymond again visited districts in Colorado, Nevada, and California. He returned to New York in November, having written only four editorial letters, all technical in content.<sup>67</sup>

Raymond's 1871 tour also was limited in scope, confined to small parts of Utah, Montana, and Nevada, but in many ways it was the high point of his travels in the West. After another late start, Raymond arrived in Montana in early August. Following brief tours of the Virginia City and Helena mining districts, Raymond turned his attention to the real object of his journey: the region surrounding the headwaters of the Yellowstone River.<sup>68</sup>

He had a long-standing interest in that region, as was apparent from the various items about the region that appeared in the Journal over the previous four years. He arranged to meet his friend Eilers at Virginia City, and there the two mining engineers joined a "sight-seeing" excursion to the geysers. Although Raymond wrote only one letter concerning the three-week tour of the area, the party included Montana journalist Cal C. Clawson, whose accounts were later published nationwide.<sup>69</sup>

"Our party was not a full-fledged affair, with wings of military escort, and claws of tools and instruments for detailed scientific investigation," wrote Raymond. Besides

Raymond and Eilers, there were only four other members: Montana journalist Calcium C. Clawson, photographer A. F. Thrasher, Indiana businessman Josiah S. Daugherty, and the group's guide, Gilman Sawtelle. A larger contingent had been expected but, according to Raymond and Clawson, "a recent raid of Sioux into the Gallatin Valley" had deterred others from the trip.<sup>70</sup>

Leaving Virginia City on August 9, the tourists hunted and fished their way up the Madison River to a rendezvous with Sawtelle. Raymond won the honor of "first blood." With Eilers' help, he bagged a large eagle after disabling it with several rifle shots, and captured her two nestlings. The two returned to camp "with their hats bedecked with trophies in the shape of eagle feathers, and an eagle hanging to the horn of each saddle, while the wings dragged the ground."<sup>71</sup>

In the hunters' absence, their companions encountered a military detachment returning to Ft. Ellis, Montana, from duty with the Hayden survey on the Upper Yellowstone. While the commanding officer offered advice as to their route, Clawson, Thrasher, and the others enjoyed a preview of sights to come. Traveling with the soldiers was the artist Thomas Moran who revealed the contents of his portfolio. It was, wrote Clawson, "crammed with fine sketches."<sup>72</sup>

Instead of continuing along the Madison River, Raymond's group diverted to Henry's Lake. Here they spent a few comfortable days at Sawtelle's ranch, preparing supplies

and exploring the country around Henry's and Red Rocks Lakes. Duck-hunting was popular, and Raymond "by stealthily snaking himself through the long grass to the borders of the sloughs and bayous, ambushed whole flocks of the feathered species . . ." In the evenings the men retired to Sawtelle's log house where, like hunters everywhere, they sat far into the night "around the blazing hearth, recounting adventures, [and] hairbreadth escapes . . ."73

Early on August 14, the adventurers headed over the divide to the Madison River along an old Indian trail east of Henry's Lake. For two days they struggled through rugged country toward and along the Madison River. While mired in sloughs and fending off swarms of mosquitoes and black flies, they managed to admire the scenery, naming features such as Cathedral Rock and Thrasher's Hole, although Raymond observed, "Doubtless Hayden or somebody came along afterward . . . and dubbed them all over again." At the discovery of their first hot spring, the weary travelers "parboiled our feet in the steaming tide" until the "fear of blisters overcame the love of Romance."74

Sawtelle's route brought the party onto the Firehole River below the lower geyser basin. Armed with N. P. Langford's magazine articles, Raymond and the others mistook this for the upper geyser basin, and were greatly disappointed by what they found. However, they did stumble onto a spring containing the bones of a buffalo. "Everybody knows flies in

amber," wrote Raymond, "but who ever heard of a buffalo in sapphire?"<sup>75</sup>

Upriver from the geyser basin, they struck a trail left by one of Hayden's scouting parties and decided to follow it eastward to Yellowstone Lake. It was a trail, wrote Clawson,

which led us by a way we knew not and by hell, which we will never go again. . . . a fit path only for a soldier who contracts to wrestle with Death, or the Christian whose lamp is ever trimmed and burning.

As Raymond's band fought its way over the trail, they encountered treacherous thermal areas, causing the reporter to declare that "the gates of the Infernal Region were not only ajar, but clear off their hinges!"<sup>76</sup>

Finally emerging on the west shore of Yellowstone Lake, the party camped beside more geysers and springs. These they put to use, suspending kettles of beans and dried fruit over the boiling water to cook all night.<sup>77</sup>

After traveling northeast around the lake, the travelers' next camp was on the Yellowstone River. Here Raymond was on guard duty the night an earthquake struck. Of the incident he later wrote:

. . . the emotion produced by the experience at such an hour, in the solemn woods, was a unique combination of awe and nausea. I was not sorry that one or two of the party were waked by it: under the circumstances, I was gratified for a little conversation.<sup>78</sup>

Moving down the river the next day, the expedition paused at the mud volcanoes, while Raymond gathered "beautiful



specimens of crystallized sulphur." The entire group watched in horror as the ground beneath Thrasher's feet gave way, plunging him hip-deep into the hot water. However, the photographer scrambled out unhurt. Along this stretch of river, they met Lt. Gustavus Doane, who informed them of their error at the lower geyser basin. After exploring the Canyon and Falls area, the members of the Raymond expedition parted ways. Sawtelle and Thrasher remained on the Yellowstone, where Thrasher intended to spend two more weeks taking views. However, for Clawson, Eilers, Daugherty, and himself, Raymond said, "Duty called, and lack of provisions and ammunition induced us to listen." Raymond and his companions headed west to the Firehole River and lower geyser basin. En route they found enormous hot springs but, wrote Raymond, "such sights are grown familiar to us by this time, and we do not even ford the stream to take a closer look at them."<sup>79</sup>

They hurried along the Firehole to the Upper Basin, finally recognizing Langford's wonders. Here they admired and examined the various geysers for a day, astonished by the Giant's "monstrous" three-hour eruption. The Grotto proved a close call for one member of the party. After the others had put their faces inside to study the geyser's interior, one adventurer, never identified, was about to enter the formation bodily. He was barely dissuaded by his friends when the Grotto erupted. For Raymond, however, the high point of the upper basin was Old Faithful, "the most beautiful geyser of

all." In a description highly reminiscent of his 1868 visit to Yosemite Falls, he wrote: "At intervals during the night we turned our heads, without rising, as we heard Old Faithful's booming signal, and beheld through the trees, the pillar of cloud, snow-white and sparkling in the starry night."<sup>80</sup>

After returning to Sawtelle's ranch, Raymond and the others headed back down the Madison toward Virginia City. To their surprise, they encountered a band of mounted Indians, who gave chase on the opposite side of the river. Clawson believed the Indians meant to head them off at a point downstream. The tourists coolly dismounted and checked their cinches, while Raymond put "the double-diamond hitch to the pack." With everything secured, they continued on their way at a dead gallop, outdistancing the Indians and arriving at Virginia City two days early. Of the incident Raymond wrote, ". . . there was no fighting done, and our running was executed with dignified firmness."<sup>81</sup>

Raymond's excursion left him too tired to write an adequate description for the Journal. He said only that "the accounts of travellers hitherto published are not exaggerated, but, on the contrary, fall short of reality." The experience, however, left a lasting impression on Raymond. He later wrote his own lengthy account of his time among the geysers and, in later years, it was invariably the memory of his Yellowstone

trip that Raymond cited in recalling his "Western adventures."<sup>82</sup>

Nonetheless, during his return trip from Montana, it was clear that Raymond no longer enjoyed the day-to-day challenges of frontier travel. The "dismal, dreadful" ride in a crowded stage between Virginia City and Corinne, Utah merited several paragraphs of description, "the smarting collection of three days and four nights . . . on the road." Wrote Raymond, "Ask any old Western traveller what is the briefest phrase expressive of deep human misery, and he will promptly answer, "Nine inside." After touring mines in Utah and Nevada, Raymond returned home to New York in late September.<sup>83</sup>

That Raymond's subsequent trips were neither so extensive nor well-recorded is due to a number of factors. His later tours were mostly revisitations of areas now familiar to him and to his readers. Such travel no longer revealed the novel experiences that inspired much of his narrative writing. In 1872 he returned to Colorado, Utah, Nevada, and California. In 1873 he had time only for a two-week trip to New Mexico before sailing to Europe and the Vienna Exposition. Of his 1874 tour, little more is known than that he visited mines in central and southern California in June and was back in New York by early September. Although his contemporaries' retrospectives indicate that he made a

Western journey for each year of his commissionership, there is no evidence that he traveled West in 1875.<sup>84</sup>

1871 was a professional turning point for Raymond. That spring he had participated in the founding of the American Institute of Mining Engineers (AIME), a professional association he had advocated for some time. The Institute's first president, David Thomas, was elderly and his election was largely honorary. As vice-president Raymond performed many of the president's functions as well as editing the Institute's transactions for publication in the Journal. From 1871 on, Raymond was increasingly absorbed in AIME activities, eventually regarding the Institute as his "life's work."<sup>85</sup>

At nearly the same time as the foundation of AIME, Raymond and two other mining engineers formed the Scientific Publishing Company. In late May, they purchased the Journal from Western and Company. Raymond's editorial duties were now compounded with management responsibilities as well.<sup>86</sup>

Raymond also showed signs of discontent with his role as commissioner. Although he had succeeded in securing the appointment of Anton Eilers as deputy commissioner, Raymond was repeatedly thwarted in his attempts to get adequate funding for other aspects of the work, particularly systematic record-keeping of mine statistics. His frustration (increased by protracted delays in the government printing of his 1869 and 1870 reports) dulled his enthusiasm for long weeks of travel and report-writing.<sup>87</sup>

Finally, the need for the commissioner to make extensive tours lessened as he located reliable agents and correspondents in the mining districts. Raymond believed that, by virtue of their residence in those districts, such men were better qualified to assess mining progress than a commissioner on an annual tour. With more of the collection of statistics and writing of district reports left to correspondents, Raymond's role was increasingly that of an organizer and compiler rather than eye-witness.

## ENDNOTES

<sup>1</sup>Engineering and Mining Journal 81 (31 March 1906):611; Ibid., 107 (18 January 1919):136; John R. Howard, Remembrance of Things Past: A Familiar Chronicle (New York: Thomas Y. Crowell Co., Publishers, 1925), pp. 123, 210.

<sup>2</sup>Engineering and Mining Journal 4 (24 August 1867):120; Ibid., 81 (31 March 1906):611; Ibid., 107 (18 January 1919):136; Clark Spence, Mining Engineers in the American West: The Laceboot Brigade, 1849-1933 (New Haven: Yale University Press, 1970), pp. 4, 18, 62, 324-329.

<sup>3</sup>Engineering and Mining Journal 7 (12 June 1869):376; Ibid., 7 (26 June 1869):406; John R. Howard, Remembrance, p. 123.

<sup>4</sup>Engineering and Mining Journal 81 (31 March 1906):610.

<sup>5</sup>Spence, Mining Engineers, pp. 60-69, 84; T. A. Rickard, ed., Rossiter Worthington Raymond: A Memorial (New York: American Institute of Mining Engineers, 1920), p. 17.

<sup>6</sup>Rickard, ed., Memorial, pp. 46, 66; Engineering and Mining Journal 103 (28 April 1917):762; J. R. Howard, Remembrance, p. 210.

Stetfeldt was a pioneering metallurgist whose improved furnace design was a significant advance in handling the sulphide ores common in the western United States.

Herman Credner, a geologist, undertook detailed studies of the geology of New York and the upper Midwest, particularly the copper deposits of Michigan's Keweenaw Peninsula. After his return to Germany in the 1870s, he authored a major text, Elemente der Geologie, and was one of the first to understand the effects of Europe's ice ages.

Anton Eilers traveled much of the West as Raymond's deputy during the latter's tenure as U.S. Mining Commissioner (1868-1876). Following Raymond's resignation, Eilers embarked on a career as a metallurgist and smelter manager. In 1890 he organized the Montana Smelting Company, forerunner of the American Smelting and Refining Company (ASARCO), of which he was a director until his retirement in 1910.

Hahn was a prominent metallurgist and businessman.

<sup>7</sup>Engineering and Mining Journal 81 (31 March 1906):611.

<sup>8</sup>Ibid., 7 (26 June 1869):406.

<sup>9</sup>Ibid., 12 (18 July 1871):41; Ibid., 81 (31 March 1906):606; Willard P. Ward Interview, 2 June 1925, Engineering and Mining Journal Historical File, McGraw-Hill Corporate Archives, New York, New York. (Typescript.)

<sup>10</sup>Engineering and Mining Journal 4 (13 July 1867):24; Ibid., 81 (31 March 1906):607, 611.

<sup>11</sup>Ibid., 4 (21 December 1867):395; Ibid., 107 (18 January 1919):139; Spence, Mining Engineers, p. 25.

<sup>12</sup>Engineering and Mining Journal 81 (31 March 1906):612.

<sup>13</sup>Ibid., 4 (24 August 1867):120; Spence, Mining Engineers, pp. 70-74; Otis E. Young, Western Mining: An Informal Account . . . From Spanish Time to 1893 (Norman: University of Oklahoma Press, 1970), p. 8.

<sup>14</sup>Engineering and Mining Journal 4 (21 December 1867):395.

<sup>15</sup>Ibid., 4 (2 November 1867):282.

<sup>16</sup>Ibid., 4 (20 July 1867):40.

<sup>17</sup>Josiah D. Whitney (1819-1896) was already well-established as a metallurgist, chemist and geologist when he assumed the directorship of the California Geologic Survey in 1860.

Clarence King (1842-1901), a Yale-trained geologist, played a major role in the explorations of the California survey before becoming director of the Geological and Geographical Exploration of the Fortieth Parallel in 1867.

James D. Hague (1836-1908) was a Freiberg-trained mining engineer who joined King's survey in 1867. He later achieved both wealth and professional distinction as a consulting engineer and mine manager.

For brief biographies of these men and an account of their survey activities, see William H. Goetzmann, Exploration and Empire: The Explorer and Scientist in the Winning of the American West (New York: W. W. Norton and Company, 1978.)

<sup>18</sup>Engineering and Mining Journal 4 (28 September 1867):201; Ibid., 4 (28 December 1867):407.

<sup>19</sup>Ibid., 4 (7 December 1867):362; Ibid., 4 (21 December 1867):392; Ibid., 4 (28 December 1867):407; Ibid., 5 (11 January 1868):24.

<sup>20</sup>Ibid., 5 (21 March 1868):185; Ibid., 81 (31 March 1906):611; David M. Goodman, A Western Panorama, 1849-1875: The Travels, Writings, and Influence of J. Ross Browne (Glendale: Arthur H. Clark Company, 1966), pp. 221-223, 242-243; Francis J. Rock, J. Ross Browne: A Biography (Washington, D.C.: Catholic University of America, 1929), p. 3.

<sup>21</sup>Engineering and Mining Journal 4 (3 August 1867):75; Ibid., 4 (12 October 1867):232.

<sup>22</sup>Ibid., 5 (21 March 1868):184; Ibid., 5 (4 April 1868):217.

<sup>23</sup>Rossiter W. Raymond to Louis Janin, 31 March 1909, Huntington Library, Janin Family Correspondence, San Marino, California, pp. 10-11; Joseph P. Howard, Abraham Howard of Marblehead, Massachusetts and His Descendants (New York, Privately printed, 1897), p. 40; Engineering and Mining Journal 5 (4 April 1868):218, reprint from New York Times, n.d.; Engineering and Mining Journal 31 (9 April 1881):245; Ibid., 81 (31 March 1906):611.

See also William Goetzmann, Exploration and Empire: The Explorer and the Scientist in the Winning of the American West (New York: W. W. Norton & Company, 1966), p. 372. Goetzmann describes the political maneuvering surrounding the selection of the California Geologic Survey director in 1864, a position for which W. P. Blake was also proposed.

<sup>24</sup>Engineering and Mining Journal 6 (26 December 1868):404; Rossiter W. Raymond, Statistics of Mines and Mining in the Territories West of the Rocky Mountains: Report of the Commissioner for 1869 (Washington, D.C.: Government Printing Office, 1869), p. 1.

<sup>25</sup>Engineering and Mining Journal 5 (9 May 1868):296.

<sup>26</sup>Ibid.

<sup>27</sup>Ibid., 5 (25 April 1868):264; Ibid., 6 (4 July 1868):9-10; Raymond, Statistics: 1869, p. 3.

Not even personal considerations delayed his departure. Raymond's wife was then in her final month of pregnancy. Their daughter was born mid-June.

<sup>28</sup>Engineering and Mining Journal 5 (30 May 1868):345.

<sup>29</sup>Ibid., 5 (20 June 1868):393.

<sup>30</sup>Ibid., 6 (4 July 1868):9-10.

<sup>31</sup>Mining and Scientific Press 5 (6 June 1868):370.



- <sup>32</sup>Engineering and Mining Journal 6 (4 July 1868):9.
- <sup>33</sup>Ibid., 6 (11 July 1868):24.
- <sup>34</sup>Ibid., 6 (18 July 1868):41; Ibid., 6 (25 July 1868):56; Ibid., 6 (1 August 1868):73.
- <sup>35</sup>Ibid., 6 (8 August 1868):89.
- <sup>36</sup>Holway R. Jones, John Muir and the Sierra Club: Battle for Yosemite (San Francisco: Sierra Club, 1965), pp. 28-29; Carl P. Russell, "Birth of the National Park Idea," Yosemite: Saga of a Century, 1864-1964 (Oakhurst, CA: Sierra Star Press, 1964), p. 5; Hans Huth, "Yosemite: The Story of an Idea," Sierra Club Bulletin, March 1948, pp. 66-68; H. Duane Hampton, How the U.S. Cavalry Saved Our National Parks (Bloomington: Indiana University Press, 1971), pp. 17, 132.
- <sup>37</sup>Engineering and Mining Journal 6 (8 August 1868):89. ←
- <sup>38</sup>Ibid., 6 (29 August 1868):137.
- <sup>39</sup>Ibid., 6 (12 September 1868):169.
- <sup>40</sup>Ibid., 7 (20 March 1869):184.
- <sup>41</sup>George W. Maynard in Rossiter Worthington Raymond: 1840-1910, ed. Charles W. Goodale (n.p., 1910), pp. 56-57.
- <sup>42</sup>Engineering and Mining Journal 6 (31 October 1868):280.
- <sup>43</sup>Raymond, Statistics: 1869, p. 1; Engineering and Mining Journal 7 (20 March 1869):184.
- <sup>44</sup>Engineering and Mining Journal 7 (20 March 1869):184; Alta California, 6 April 1869.
- <sup>45</sup>Engineering and Mining Journal 7 (1 May 1869):281; Ibid., 7 (8 May 1869):297.
- <sup>46</sup>Rossiter W. Raymond, Statistics of Mines and Mining in the States and Territories of the Rocky Mountains: Annual Report of Rossiter W. Raymond, U.S. Commissioner of Mining Statistics: 1873 (Washington, D.C.: Government Printing Office, 1873), p. 5.
- <sup>47</sup>Mining and Scientific Press (2 October 1869):216; Raymond, Statistics of Mines and Mining in the States and Territories of the Rocky Mountains: Annual Report of Rossiter W. Raymond, U.S. Commissioner of Mining Statistics: 1870 (Washington, D.C.: Government Printing Office, 1870), p. 510; Engineering and Mining Journal 25 (27 April 1878):287; Ibid.,

25 (18 May 1878):339; Transactions of the AIME vol. 3, pp. 204-205.

<sup>48</sup>Raymond, Statistics of Mines and Mining in the States and Territories of the Rocky Mountains: Annual Reports of Rossiter W. Raymond, U.S. Commissioner of Mining Statistics: 1871 (Washington, D.C.: Government Printing Office, 1871), p. 320; Raymond, Statistics: 1873, p. 334; Engineering and Mining Journal 8 (5 October 1869):211.

<sup>49</sup>Engineering and Mining Journal 13 (25 June 1872):407; Ibid., 19 (16 January 1875):36; Ibid., 19 (17 April 1875):265; Raymond, Statistics: 1869, p. 1 et seq.; Raymond, Statistics: 1873, p. 8.

<sup>50</sup>Engineering and Mining Journal 6 (31 October 1868):280; Ibid., 107 (18 January 1919):136-139; Rickard in Memorial, pp. 8-10; Arthur S. Dwight in Memorial, p. 64.

<sup>51</sup>Engineering and Mining Journal 8 (3 August 1869):67.

<sup>52</sup>Ibid., 12 (11 July 1871):25-26.

<sup>53</sup>Ibid., 7 (19 June 1869):393.

<sup>54</sup>Ibid., 16 (15 July 1873):40.

<sup>55</sup>Ibid., 8 (20 July 1869):35.

<sup>56</sup>Ibid., 8 (27 July 1869):51; Rossiter Worthington Raymond, Statistics of Mines and Mining in the United States and Territories of the Rocky Mountains: Report of the Commissioner for 1868 (Washington, D.C.: Government Printing Office, 1869), p. 168; Edmund Wilson, Jr. in "Profiles: Landscapes, Characters and Conversations from the Earlier Years of My Life," The New Yorker 43 (29 April 1967), p. 118; Engineering and Mining Journal 10 (4 October 1870):217.

<sup>57</sup>Engineering and Mining Journal 8 (27 July 1869):51; Transactions of the AIME vol. 33, p. 619.

<sup>58</sup>Engineering and Mining Journal 6 (7 November 1868):296.

<sup>59</sup>Thurman Wilkins, Clarence King: A Biography (New York: The MacMillan Company, 1958), p. 186; Engineering and Mining Journal 27 (15 March 1879):179.

<sup>60</sup>Engineering and Mining Journal 8 (31 August 1869):131.

<sup>61</sup>Ibid., 8 (7 September 1869):147.

<sup>62</sup>Ibid.

<sup>63</sup>Ibid., 8 (14 September 1869):169.

<sup>64</sup>Ibid., 8 (21 September 1869):178.

<sup>65</sup>Ibid., 8 (28 September 1869):194.

<sup>66</sup>Ibid., 8 (5 October 1869):211; Ibid., 8 (19 October 1869):249.

<sup>67</sup>Ibid., 10 (9 August 1870):81; Ibid., 10 (25 October 1870):266; Ibid., 10 (1 November 1870): 281; Ibid., 10 (8 November 1870):298; Ibid., 10 (29 November 1870):345; Ibid., 10 (6 December 1870):361.

<sup>68</sup>Ibid., 12 (15 August 1871):105; Ibid., 12 (August 22 1871):111, 121; Ibid., 12 (5 September 1871):153; Ibid., 12 (12 September 1871):169; Ibid., 12 (31 October 1871):276.

<sup>69</sup>Ibid., 4 (9 November 1867):298; Ibid., 5 (16 May 1868):306; Ibid., 12 (17 September 1871):185; Ibid., 103 (28 April 1917):762; New Northwest (Deer Lodge, MT), 9 September 1871 et seq.

<sup>70</sup>Rossiter W. Raymond, Camp and Cabin: Sketches of Life and Travel in the West (New York: Fords, Howard and Hulbert, 1880), p. 172; New Northwest, 23 September 1871 and 30 September 1871; Bob R. O'Brien, "The Roads of Yellowstone, 1870-1915," Montana Magazine of Western History 17 (July 1867), p. 31.

<sup>71</sup>Raymond, Camp and Cabin, p. 172; New Northwest, 23 September 1871; Ibid., 30 September 1871.

<sup>72</sup>New Northwest, 23 September 1871.

<sup>73</sup>Ibid., 14 October 1871; Ibid., 4 November 1871; Ibid., 11 November 1871.

<sup>74</sup>Ibid., 11 November 1871; Ibid., 18 November 1871; Engineering and Mining Journal 55 (11 March 1893):219; Raymond, Camp and Cabin, pp. 167-169, 178.

<sup>75</sup>Raymond, Camp and Cabin, pp. 186-189, 191; Engineering and Mining Journal 55 (11 March 1893):219.

<sup>76</sup>New Northwest, 16 December 1871.

<sup>77</sup> Ibid., 27 January 1872, p. 1; Raymond, Camp and Cabin, p. 202.

<sup>78</sup>Raymond, Camp and Cabin, p. 176; Engineering and Mining Journal 55 (11 March 1893):219; New Northwest, 11 June 1872, p. 2.

<sup>79</sup>Raymond, Camp and Cabin, pp. 192-193, 200, 203-204; Engineering and Mining Journal 55 (11 March 1893):219.

<sup>80</sup>Raymond, Camp and Cabin, pp. 196-198.

<sup>81</sup>Ibid., p. 200; New Northwest, 1 June 1872, p. 2; Raymond, Camp and Cabin, p. 200.

<sup>82</sup>Engineering and Mining Journal 12 (19 September 1871):185; Ibid., 103 (28 April 1917):762.

<sup>83</sup>Ibid., 12 (19 September 1871):185.

<sup>84</sup>Ibid., 16 (14 October 1871):185.; Ibid., 107 (18 January 1919):136; Raymond, Statistics: 1873.

<sup>85</sup>Engineering and Mining Journal 11 (9 May 1871):297; Ibid., 11 (30 May 1871):345; Rickard in Memorial, pp. 8-9; A. B. Parsons, ed., Seventy Five Years of Progress in the Mineral Industry: 1871-1946 (New York: American Institute of Mining Engineers, 1947), p. 6.

<sup>86</sup>Engineering and Mining Journal 81 (21 March 1906):608.

<sup>87</sup>Ibid., 9 (22 March 1870):193; Ibid., 10 (6 December 1870):361; Ibid., 12 (3 October 1871):217; Ibid., 12 (20 December 1871):409; Ibid., 13 (25 June 1872):407; Ibid., 19 (17 April 1875):265; Ibid., 19 (16 January 1875):36.

## CHAPTER THREE

### "SCALPS AND COWCATCHERS":

#### THE EDITORIAL PAGE

The years 1868-1876 were busy ones for Raymond. As he described his activities during this period, "I practically edited the Journal with one hand, while discharging official duties and earning my living by professional work with the other."<sup>1</sup>

Editing the Journal was literally a labor of love for Raymond, as the time it required far exceeded the profits it generated. His assistant Willard Ward remembered that Raymond would sit up late at night writing articles, children's stories, and poems to bring in extra cash. This, together with savings from his commissioner's salary "would go out in a cheque Saturday noon to old Brady, the typesetter . . . who had to have his money before he would let the forms out of his possession to go to the press." Benjamin Western, the Journal's advertising agent, "had a very pretty knack of making cheques do double duty when required." Whenever copy was scarce, Ward would ply commissioner's assistant Anton Eilers with "cheap red Rhine wine," then argue with him on a technical problem until Eilers vowed to write an article to

prove his point. The editorial staff, said Ward, never thought of profits or dividends: "The only apology we had for existence was the enlightenment of the profession."<sup>2</sup>

While it was true that the Journal's technical and scientific content was geared to mining engineers, Raymond wrote the editorial page with a broader focus. There he spoke both for and to the mining industry, expressing mining's needs and examining its internal problems. Because the West was the scene of greatest mining activity at the time, Raymond's editorials reflect that regional orientation. In expressing his views on American mining, he was also expressing a view of the West. Raymond's was an engineer's perspective, a utilitarian focus that regarded the land in terms of its exploitable resources.

Yet, for Raymond as for many other European-trained mining men, their industry transcended simple economic activity; it was nothing less than the front-line of civilization. Agriculture might be essential to survival, but the products of the mines elevated men from savagery.<sup>3</sup> What might have been mere historical theory to men in another place and time was an uncontestable fact to the engineers of Raymond's day, eye-witnesses to the development of the American West. Were it not for mining, Raymond insisted,

. . . the Great West would be now, as twenty years ago, known only to the trader and trapper. . . . It was a search for precious metals that first carried the adventurer away from the culture and comforts of an Eastern home, across the plains, and over the Sierras. . . .<sup>4</sup>

But when Raymond spoke of mining civilizing the West, he was not referring to highly individualistic placer miners. These men skimmed the surface deposits, while leaving the West's real wealth locked in the earth. "Theirs was a nomadic life," he wrote, "they needed no capital; the coarser articles of subsistence and a few rough tools made up the stock in trade. . . . What they build today, they take down tomorrow."<sup>5</sup> They were miners, but they were not the mining industry. The mining West envisioned by Raymond and his fellow engineers was not one of "boom or bust," but rather one in which for "centuries to come the work of the miner and smelter will be the great and leading industry. . . ."<sup>6</sup> Raymond believed that through efficient and prudent management of mines, such long-term exploitation of a finite resource was possible.

Industrial mining, however, required vast amounts of capital, amounts not risked lightly on the mere existence of mineral deposits. Investors needed the probability that ores could be mined, processed, and marketed successfully. Raymond generally endorsed the prevailing economic philosophy of laissez faire capitalism. However, because most mineral lands were in the public domain, and because development of the West's resources was in the national interest, Raymond believed the federal government had a responsibility to assist the mining industry. Government assistance, he wrote, should

come in the form of communication (transportation), protection (military), regulation (mining law), and information.<sup>7</sup> A major portion of his Western editorials addressed these themes.

Transportation meant railroads, "clearly necessities to Western mining and the handmaids of their prosperity," declared Raymond. In his view, completion of the transcontinental railroad was the government's most pressing responsibility to the mining industry. His concern was sparked by increasingly vocal critics of the project who attacked the government's "excessive generosity" toward the railroad companies and denounced the poor quality of the completed sections. In a series of five editorials between November 1867 and February 1869, Raymond examined various aspects of the transcontinental road: its potential impact on the West, construction progress and quality, financing, and its "effect on foreign nations."<sup>8</sup>

In Raymond's view, the decision to build the railroad, made as the country was "in the darkest crisis of our history," was a courageous act of patriotism. The construction itself represented a monumental achievement of engineering and labor. The commercial success of the still-incomplete railroad justified the undertaking, but he believed the road's significance for Western defense was equally important. Raymond argued that it was less expensive to build two railroads than to fight one Indian or Mormon war, that the



"average cost of killing a single Indian . . . will build and equip a mile of railroad." Even more important to the mining editor were the railroad's implications for the West in renewing and expanding its mineral industry:

When we consider the achievements of mining enterprise in the west and bear in mind that they have been accomplished almost without the aid of those means of communication which are ordinarily considered, in these days, essential to industry and commerce, we can scarcely set a limit to the splendid developments of the future . . .<sup>9</sup>

Writing from his own experience on the Pacific railroad route in September 1868, Raymond defended the road's progress and construction. As a passenger, he declared the Union Pacific "one of the smoothest roads in the country," and that of the Central Pacific, "very good." As an engineer he explained the various construction methods which made them so. About the road's critics Raymond concluded, "People talk very smartly about what it costs to build a road, but they do not know very much about it."<sup>10</sup>

According to Raymond, the controversy was largely the result of sour grapes: "Those who were afraid to take up this enterprise have found out that it is a very profitable thing for those who did take it up." Far from begrudging the railroad companies their profits, Raymond believed the capitalists were reaping their just rewards for the risks they had taken. Profits were, after all, the reason why these men were in business. It was not often, he observed that men

sought wealth "in ways so thoroughly and permanently beneficial to the whole community."<sup>11</sup>

As for the alleged excessive generosity of the road's government financing, Raymond pointed out that the benefits reaped would more than pay off the \$50,000,000 loan. He cited three points in particular. First, improved movement of troops and supplies would enable the Army to manage with fewer troops and without the huge accumulation of material previously needed in the West. Raymond thought that this alone would eliminate much expense, waste, and corruption: "Army contracts on the plains will cease to be proverbially 'fat things.' Quartermasters will not get suddenly rich, and a suttlership will not be equivalent to an independent fortune." Second, the presence of the railroad would discourage both Mormon and Indian wars, "the most expensive undertakings, in proportion to their magnitude, in which the country was ever engaged." Third, the resulting rapid settlement and development of natural resources would "add so much to the wealth and power of the country that its ability to pay not only the railroad bonds, but the whole national debt will be put beyond question or cavil." Even at a reduced rate, the government's use of the road would swell its profitability.<sup>12</sup>

Finally, Raymond appealed to his readers' national pride. The building of a railroad in a wilderness, establishing population and commerce where none previously

existed was, he wrote, "an American idea." He pointed out that China and Russia, countries with similarly vast areas of territory, were carefully studying the transcontinental undertaking. Raymond hoped such foreign interest would convince skeptical Americans of the railroad's importance to their own country. It was, he insisted, the extension of the railroad in advance of settlement that, more than anything else, brought about "the enormous progress of this nation in the conquest of a continent."<sup>13</sup>

In 1871, Raymond again undertook an editorial campaign on behalf of the Northern Pacific. This time it was an answer to warnings from "financiers and economists of the old school" who denounced "the enormous issue of railroad bonds which load the market. . . . They do not see where all this capital comes from, and they croak of inflation and disaster. . . ." Raymond dismissed the warnings, declaring that construction of the northern road was part of the national destiny:

Nature has bound us together by great rivers and mountain chains running north and south. It is left for man to rib the continent east and west with railways, and so create a well-knit framework which no power can break asunder.

Raymond disagreed that railroad indebtedness was out of proportion to the wealth of the country. The resources of the West were awaiting development, the riches released by the benefits of the railroad would more than offset the cost of construction. Besides, he pointed out that the railroad's underwriter was Jay Cooke & Company, "men who are universally

considered to be at once intellectually able to manage such vast affairs, and morally worthy to be intrusted [sic] with them."<sup>14</sup>

The mining editor campaigned for the Northern Pacific for nearly two years, stressing the safe investment represented by the company's bonds. It was a disastrous misjudgment on Raymond's part, as Jay Cooke's banking house seriously over-extended itself on the railroad's bonds and collapsed. The Cooke failure precipitated a nationwide depression, the Panic of '73, and the presumably embarrassed Raymond wrote little about national railroads for several years.<sup>15</sup>

In Raymond's mind the problems of transportation and protection were linked. In the aptly titled "Scalps and Cowcatchers," written in 1867, Raymond detailed his views of the "Indian problem," views reflecting both the idealism of his Abolitionist upbringing and an engineer's blunt pragmatism.

Raymond acknowledged that the government's existing policy had subjected the Indian to a variety of injustices. He cited Westerners who "systematically spread false reports in the hopes of precipitating an Indian war" and a treaty process in which "unscrupulous men seem, too frequently to get the better of the scrupulous commissioners." As a result, "The Indians always break their pledges and we never keep ours." Raymond believed that the Indians were justified in

some cases for fighting the white man. Pointing out instances where settlers "in Montana and elsewhere" had attacked friendly and hostile tribes indiscriminately, Raymond declared that "The Indian who would remain friendly after such treatment as that must be a Digger."

Raymond's solution to the Indian problem must have startled his Western readers. He called for setting aside the "fiction" of tribal sovereignty in order to provide the Indian with "real security and liberty":

For their sakes, as well as ours, the Indians must become citizens of the United States. The West must be reconstructed like the South. The protection which the Freedman's Bureau has given to the negro must also be provided for the Indian.

As idealistic as this proposal appeared, Raymond supported it with an argument based on efficiency, not morality.

The government's policy of military reprisal only incited another violent response from the Indians, said Raymond, "and the bloody argument goes on without possibility of decision." Extermination was out of the question--"How many would they exterminate, before the final consummation? What would be the cost of such a war at the present rate of extermination?" Reservations were equally impractical, since many tribes would resist removal "and the cost of removing even willing tribes from the North Missouri would be very great." Regardless what Indian policy the government ultimately pursued, however, Raymond insisted its immediate

object must be the protection of Western transportation routes, especially the transcontinental railroad.<sup>16</sup>

Raymond's "Scalps and Cowcatchers" editorial was written before he traveled in the West. While he never again ventured to detail his Indian views in print, it appears from his editorials that his observations convinced him of the inevitability of conflict and "the ultimate extermination or absorption of the Indian." In 1870 he wrote about the Apache, "Whatever may be said about keeping peace with the tribes of other regions, all parties are agreed that the only thing to be done with the Apaches is to fight them." Still, Raymond persisted in his belief that rapid settlement was a more effective means of dealing with the Indian than military action.<sup>17</sup>

Since Western mining districts suffered fewer Indian hostilities during the late 1860s and early 1870s, Indian policy consequently was of less concern to the mining industry. Therefore the subject received less coverage in the Journal, making it difficult to know Raymond's opinion during this period. Nonetheless, after eight years of Western travel, Raymond understood that the Indian would not be so easily swept aside by the "cowcatcher of progress." In an editorial concerning the Black Hills mining rush dated June 3, 1876, only three weeks before the Battle of the Little Big Horn, he wrote:

. . . we think the blood that has been, and will be shed in this affair too great a price for the booty

sought; and we trust the follies of the past will not be crowned with an expensive purchase of the Indian right to the Black Hills.<sup>18</sup>

Regulation, or mining law, was the third area of government policy addressed by Raymond in his editorials. Federal mining law in the late 1860s consisted of the Mining Act of 1866. This act had recognized local miners' law on the public domain, with a provision for purchase of permanent rights from the United States. A major flaw in this act was its failure to grant exclusive surface rights to locators, leaving them only an easement to occupy such surface area as needed for mining purposes. The result was a situation such as Raymond had witnessed on his first visit to Virginia City, Nevada--an "amazing complex of dumps, ore-bins, roads, shafthouses, derricks and whims, interspersed with hotels, saloons, stores and residences."<sup>19</sup> Nor was the confusion confined to the surface. In districts where veins were interrupted by frequent faults it was difficult to prove a vein's identity below ground, once crossed and dislocated by a fault. Under the 1866 law, a locator had little legal protection from intruders who worked into his vein beyond a fault, claiming it as their own. The only recourse was a lengthy and expensive legal battle. Deliberate vein piracy and blackmail were common. Lack of regulation resulted in chaos in mining records as well, described by Raymond in 1870:

At present, the titles to property worth millions of dollars are to be found in loose sheets, pocket-books,

greasy, singed; torn and illegible old ledgers, or what not, kicking about miners' cabins, groceries or barrooms.<sup>20</sup>

To Raymond this state of affairs was the most serious obstacle facing the Western mining industry. An insecure title was no concern to an individual miner "who, if he is ejected today, can pack up his tools, move away a rod or two, and have a new mine in full blast tomorrow." However, the future of the industry depended upon capital investment in mines and permanent works. Without secure titles, few investors were willing to risk their money.<sup>21</sup>

Raymond pressed for reform of federal mining law. Ideally he wished to see the institution of a systematic mining code like those of Europe to replace the patchwork of miners' law, state/territorial, and federal regulation. Raymond believed it was an unfortunate aspect of democracy that such a uniform code could not be arbitrarily imposed by the federal government, and he did not believe the average mining camp resident wise enough to surrender "existing privileges" for the greater long-term good.<sup>22</sup>

In 1872 a new mining act was passed, due in great part to Raymond's efforts. It remedied the principal defects of the old law by granting surface ownership to the lode-locator, requiring a certain amount of work annually to maintain the promissory title, and providing for proper record and definition of claims. What lawmakers (and Raymond) failed to anticipate was that subsequent court decisions would interpret



the new law as in fact making the mining right contingent upon the surface location, rather than recognizing the surface right as an appurtenance of the mining right. The Act of 1872 came to be known (due to Raymond's use of the term) as the Apex Law, and in itself triggered yet another massive wave of mine litigation.<sup>23</sup>

Another aspect of mine regulation, in Raymond's opinion, was the issue of timber conservation. Although he had expressed concern about the needless waste of Western timber resources as early as 1867, it was his first-hand look at forest fires in California and Oregon in 1869 that convinced him to devote several editorials to the problem. He believed the solution was the rapid survey and sale of public timberlands, thereby placing the forest in private ownership. He reasoned that private landowners would, by reason of self-interest, manage the resource more efficiently and protect it against wanton destruction.<sup>24</sup>

Raymond's reasoning on the timber issue is reflective of his views on the conservation of other natural resources, including (somewhat surprisingly) Yellowstone National Park. Shortly after creation of the park in 1872 Raymond wrote that the action "seems to have been dictated by a gush of enthusiasm over the beauties described by . . . explorers, and . . . received with a similar gush on behalf of the newspaper press. . . ." Raymond's conservation ethic was one based entirely on utilitarian values. His goal was the protection

of valuable resources from waste so that they might be wisely put to productive use. Preservation of a natural area for aesthetic purposes was, in his opinion, a waste. Of the law establishing Yellowstone Park he wrote:

In sober truth, the law is a piece of absurdity. The arguments by which it was urged have no tangible form. It is not necessary to "preserve" the scenery of the Yellowstone; and if it were necessary, making a reservation of such vast extent would be the last means to accomplish it. Everybody in the West knows that public lands are more subject to depredations, forest-fires etc., than any others.<sup>25</sup>

Raymond thought the most important assistance the government could render the mining industry was in the gathering and dissemination of information regarding mineral resources and mining processes.<sup>26</sup> In spite of efforts by a small corps of trained engineers, waste was rampant in Western mines. The problem, as Raymond saw it in 1867, was the abundance of easily-worked deposits and the greed of Western miners. Frontier miners had little interest in the efficient development and prolonged production of their mines. Theirs was generally a get-rich-quick attitude, seeking maximum immediate profit with a minimal investment. When the easily-worked surface deposits of one claim played out, such miners simply moved on to another, leaving potentially productive ore bodies abandoned, or worse yet, rendered unprofitable through poor mining practices. Raymond thought the fact that most Western mines were on public land encouraged such wastefulness, comparing miners' attitudes to those of the

Indian: "One might as well expect the Indian to commence scientific stock-raising while the prairie swarms with buffalo. He cuts out the hump and the tongue, throws away the carcass . . . and laughs at your notions of economy and industry." Raymond had admired the efficiency of government-directed mining in Europe, but he admitted that only a despotic government could eliminate waste by arbitrary measures. "A democratic government," he wrote, "must stop it by teaching the people better."<sup>27</sup> It was this educational role of the government that concerned Raymond when he wrote about the various government surveys and his own work as mining commissioner.

The national geological surveys were of vital importance for the information they rendered about the West's geology and mineral lands. Raymond believed their work prevented much wasted effort by miners and provided a rare opportunity for planned development of resources. He did, however, criticize the national surveys, as he had the California survey, for frequent delays in publishing results useful to the mining industry.<sup>28</sup>

Raymond's interest in the surveys was not confined to their mineral work. He regularly reported scientific and geographical discoveries, and believed that the surveys, in promoting knowledge of the West and an appreciation of its value, helped to "foster a spirit of patriotism and unity among our people."<sup>29</sup>

Raymond also displayed a personal interest in the surveys. Friends and fellow "Freibergerers" were numerous among survey members: the Hague brothers, S. F. Emmons, Raphael Pumpelly, and Clarence King, among others. Their adventures were frequently recounted on the editorial page of the Journal.<sup>30</sup>

As a witness to the growing rivalry among the government survey leaders during the 1870s, Raymond remained aloof, but not unbiased. Even though his own geological opinions differed greatly from Clarence King's catastrophism, Raymond admired King's work, and said so at every opportunity. He appreciated King's "vigorous prosecution" of both field and office work that led to an early publication of King's report on the mining industry in 1871. The mining report was published first, wrote Raymond approvingly, "because its subject is most directly applicable to the material development of the West."<sup>31</sup> When King's claim to discovery of glaciers in the Cascades was challenged by another mountaineer, Raymond wrote an editorial item in his defense: "Nobody cares who saw the glaciers first. . . . It is the announcement and description that constitutes true service to science."<sup>32</sup>

The infamous "Diamond Swindle" in 1872 placed Raymond in a delicate position. Henry Janin, a Freiberg-educated mining engineer with an excellent reputation, had examined a prospective diamond field for a group of San Francisco

investors. Based on Janin's favorable report, the syndicate sold stock in a highly publicized mining venture. The secrecy surrounding the diamond claim's location aroused the suspicion of King and his survey geologists. Careful investigation uncovered the site and King exposed the diamond bonanza as a hoax. King's brilliant detective work had averted a fraud of monumental proportions, but it had also embarrassed Janin, a prominent member of the mining profession and close friend of Raymond. Like many other engineers, Raymond was aghast at Janin's mistakes and regarded the affair as a tremendous blow to the cause of science in mining. Nonetheless, in a masterfully diplomatic editorial, he managed to applaud King's triumph, uphold Janin's reputation, and warn his profession of the evils lurking in the hearts of speculators.<sup>33</sup>

Raymond's relationship with another government surveyor, Ferdinand V. Hayden, was of an entirely different nature. Although Raymond admitted, "There is no doubt that Hayden's explorations have been important in the increase of our knowledge in the West," his editorial columns between 1868 and 1876 contained frequent and increasingly personal criticism of Hayden.<sup>34</sup>

Raymond's differences with Hayden began when the two met in Wyoming in 1868. The young engineer had the temerity to suggest (in person and later in print) that the famous government scientist change his geological terminology.<sup>35</sup> Raymond's early criticisms were respectful and jovial, but in

1870 the tone changed considerably. Raymond, who abhorred the "puffery" of promotional mine literature, received a speculator's pamphlet in which Hayden had written an endorsement of a mine. Such forays into fields beyond his own geological specialty were characteristic of Hayden, but Raymond was not disposed to overlook this trespass on the domain of mining engineers. He responded sharply to Hayden's mine report:

. . . the whole of it is one of the general opinions which few men are competent to give, and then only after thorough examination and long local experience. We have always praised Prof. Hayden as a geologist in certain departments of that field. His work on the plains we have considered to be thorough and trustworthy; but we are surprised to see him in the role of a mining engineer. We esteem him too highly to be pleased to see him in a false position.<sup>36</sup>

From that time on, while always careful to praise Hayden's accomplishments, Raymond seldom missed a chance to point out his shortcomings. In 1872 Hayden's announcement of discoveries in the vicinity of Yellowstone drew a particularly heated response: ". . . the Doctor goes too far in some of the claims which he puts forward to the honor of original discovery." Particularly nettling to Raymond was Hayden's claim of discovering the passes around Henry's Lake. Raymond's party had camped at the lake and examined the passes several days prior to Hayden. Citing his and Cal Clawson's accounts, Raymond reminded Hayden that "some members of his party were so informed we personally know." Not that Raymond claimed discovery for himself, rather, he seemed simply to see

it as an opportunity to voice the growing irritation of many within the scientific community when he said of Hayden:

. . . everybody knows how valuable is the work of his survey; he need not be "monarch of all he surveys." Nay, we venture, in the words of the poet, to remind him, with great respect for his real conquests and achievements, that "the whole boundless continent ain't his'n."<sup>37</sup>

Of the leaders of the other major surveys, Raymond wrote relatively little. Comparing Powell's exploration of the Colorado to other surveys, Raymond commented in 1872 that it was "Similarly interesting, though less fruitful of results." Wheeler's exploration he praised for its "dashing and dangerous" character, but he thought that work "not extremely detailed." What weight Raymond's editorial commentary carried is not known. However, when Raymond humorously reported that Wheeler's survey used a rock from Maine as a station-marker near Georgetown, Colorado ("If there is anything abundant about Georgetown, one would say it is stone."), the sensitive Wheeler felt the indignity important enough to respond with a "wrathful" letter.<sup>38</sup>

By 1875, Raymond referred openly to "Dr. Hayden's feud with the War Department, or rather, the rivalry between him and the Army Engineers, represented by Wheeler, which breaks out every year before the Appropriations Committee." He still avoided taking sides, saying he was "inclined to believe that whoever wins, the country is well served."<sup>39</sup> But it was clear that Raymond, like many others, felt the time had come to

consolidate the surveys and eliminate wasteful duplication of effort. In January 1876 Raymond endorsed the unification of national surveys under the Army's Engineer Bureau. Relying heavily on an article written by his brother, Captain Charles Walker Raymond of the U.S. Engineer Corps, Raymond addressed the intolerable situation that had arisen amid the government's major "scientific information" agencies. Not only had "a perfect procession" of surveys covered the same ground, but they were guilty of "picking out such interesting or famous localities as seemed most likely to furnish popular material, performing hasty work, and publishing hasty reports." So-called "preliminary" results, said Raymond, "have brought confusion and bred dispute, instead of developing the truth concerning the geology of the West." Moreover, he added, "the government ought not to be paying indefinitely for such indefinite results. . . . It is as demoralizing to scientific men as it is wasteful of the public money."<sup>40</sup>

Raymond's support for military direction of the surveys may be understood in light of his admiration for the conduct of King's survey (sponsored by the War Department), possibly his family connection to the Engineer Corps, and his long-standing respect for the services rendered by military engineers. In 1870 Raymond wrote that "no one is more ready than they to assist their professional brethren outside the Army with the ripest results of their own research."<sup>41</sup> (When



the Army retired from the struggle for control of the surveys in 1878, Raymond threw his support behind the faction led by Clarence King and John Wesley Powell.)<sup>42</sup>

Raymond's own work as U.S. Mining Commissioner was frequently a topic on the Journal's editorial page. He admitted it was "convenient . . . to illustrate and defend in these columns the measures he had recommended and steps he had taken as commissioner."<sup>43</sup> His connection with the Journal brought his work considerably more exposure than it would have received otherwise. In turn, the influence of the Journal on industry opinion gave Raymond's recommendations more weight than a one-man agency might normally wield. Also, as the mining commissioner soon discovered, the printing of his annual reports was invariably delayed, sometimes by as much as a year. His editorial access allowed Raymond to communicate information from those reports to the industry while it was still applicable, fulfilling his chief obligation as a "public" scientist.<sup>44</sup>

Raymond was far from satisfied by the government's treatment of the mining commissioner in comparison to other scientific agencies. In an 1872 editorial titled "Congress and Science," he praised the U.S. Government for its support of a broad range of scientific endeavors, but in listing the appropriations for the major surveys and bureaus (Hayden, \$75,000; Wheeler and King, \$75,000; Raymond, \$15,000) Raymond observed that it was "rather a small sum, we should think,

with which to carry on any systematic work in twelve States and Territories."<sup>45</sup> Raymond also felt his work was hindered by a lack of communication from other agencies, resulting in delay and duplication of effort. His comments in 1872, when he found himself unable to get accurate information about Wyoming iron deposits, are typical of his frustration:

We trust that Professor Hayden, who has studied this region a good deal, and who is amply provided by Congress with funds for the prosecution of his geological surveys, as Geologist of these Territories, will think it worth his while, even at the risk of missing a fossil or two somewhere, to take up and examine (or employ some competent person to examine) this great and immediately important question.<sup>46</sup>

Raymond's Western editorials, however, were not exclusively concerned with the government's role in mining industry. There were, in fact, several areas in which Raymond emphatically argued against government involvement. Foremost among these was the realm of labor relations. From his very first reference to the subject, Raymond made it clear that he was opposed to miners' unions. While he recognized the right of miners to organize and to strike for higher wages, he insisted that the rightful purpose of strikes was to publicize workers' grievances. He absolutely denied the right of strikers to interfere with workers hired to replace them. Raymond believed that union efforts to obtain uniform pay and eight-hour days rewarded the lazy, incompetent worker at the expense of the skillful, industrious worker. Uniform pay, he

argued, obscured the natural distinctions wrought by ability and intelligence.<sup>47</sup> Raymond insisted that while unions might be necessary in Europe, the American wage earner led a nearly Utopian existence. American working men, he argued, earned enough to support their families without wives and children working, and that,

. . . the richest man does no more than this. He wears finer cloth and eats game when the workman is dining off beef and pork. But these are merely accidental differences which do not disturb the real equality of condition mentioned above. Sufficient food and clothing, privacy in home life and the education of his children are a sufficient reward for a day's labor, in any condition of life.<sup>48</sup>

Such an attitude might be explained in part by the fact that Raymond's close contact with the laboring classes occurred almost exclusively on the mining frontier. There, in what (to a Brooklyn brahmin) was surely an altogether primitive social setting, perhaps the distinctions between rich and poor were less discernible. But by and large, Raymond's view was quite typical of the time for men of upper-middle-class backgrounds. Moreover, Raymond's social ideas echoed those of his close friend Henry Ward Beecher. It was Beecher, after all, who once stated that a dollar a day was enough to support a man--"not enough to support a man and five children if a man insists on smoking and drinking beer. . . . But the man who cannot live on bread and water is not fit to live."<sup>49</sup>

Wages were also an issue intimately connected with the fortunes of the mining industry. In Raymond's opinion,

wages in Western camps were far too high in relation to the cost of living. According to him, such wages reflected conditions in the mining districts when skilled labor was scarce, transportation limited, and supplies expensive. With continued settlement and agricultural development, and improved transportation, the high wages could no longer be justified, and presented a major barrier to the development of the mining industry.<sup>50</sup> In Journal editorials, Western miners are generally portrayed as "industrious," "hardy," "honest," and "independent." Not so in the editorials dealing with labor unions--once associated with a union, the Western miner was pictured as an unworthy, dishonest idler who would rather demand higher wages than earn them, or as the weak, defenseless sort who had been terrorized into union membership.<sup>51</sup>

Western labor issues were invariably linked with immigration, particularly Chinese immigration. Raymond displayed an extreme disdain for uneducated European immigrants (again, an attitude common to Americans of Raymond's background.) His articles and editorials frequently contained disparaging remarks about the character and work habits of Irish and Cornish miners. When it came to the Chinese however, Raymond held an entirely different point of view. He frequently praised the Chinese laborer's character and abilities--and willingness to work for low wages. They were "far more earnest and faithful than any other miners" and

displayed a talent for mine work. Naturally the mining editor denounced efforts by Western laborers and legislators to prevent the Chinese from freely working the mines. His argument was that the lower wages accepted by the Chinese would deflate wages to a normal level, which in turn would boost mining activity. With more mines open, there would be an increased demand for the more highly-skilled American miners, whose wages would then rise once more. While the anti-labor editorials of this period were by no means as virulent as his later crusades against the Molly Maguires and Butte Miners' Union, they do make clear Raymond's views on labor in the West.<sup>52</sup>

Although unsympathetic to unions, Raymond was at the forefront of the movement to improve mine safety. He believed that legislation in this matter was best left to the states and territories, but he repeatedly stressed the urgency of the situation. The mines of Nevada were the most dangerous in the nation, with Virginia City's mines "a perpetual death trap." Raymond placed responsibility squarely on individual mine owners and companies, saying that the frequent explanation of accidents as a "result of carelessness" might be more accurately termed the result of "deliberate and prolonged carelessness on the part of owners and engineers."<sup>53</sup>

In 1874, the Journal began examining the toxic effects of mine poisons in the West. Although Raymond did not express an opinion on the harmful effects of arsenic and lead to

miners, he did paint a vivid picture of mining camps engulfed in clouds of smelter smoke, where animals died and residents sickened. He described deadly conditions in foreign countries' mines where the problem had been known for centuries, and admitted that he had long expected to see similar problems arise in American mines, "but so far the health of our mining districts has been (disappointingly?) good."<sup>54</sup>

Invariably, engineers were confident that such problems, even when created by industrial technology, could eventually be resolved by more advanced technology. Raymond shared the general optimism of his profession. "Only let us make as rapid progress in the next century as in this," he wrote, "and the world will see greater wonders than steam engines."<sup>55</sup> As a rule, Raymond confined technological discussions to the Journal's technical sections. When technology appeared on the editorial page it was somewhat more of a theme than a topic. That is, Raymond might promote a new reduction process, or comment on a controversy involving a smelting furnace, but in a subtle way he was attempting to shape his readers' view of technology. In an editorial ostensibly about the "Storage and Transportation of Petroleum" in Great Britain, Raymond pointed out that efficient supply of fuel for gaslight was a tremendous social advance for the poor: "Cheap light means evening study and domestic pleasure for the working man. Dear light means alehouse consolations,

joyless homes, neglected families and intellectual stagnation."<sup>56</sup> Raymond's concern with reshaping attitudes was understandable. There was considerable resistance to technology within the mining industry, personified by the animosity of the practical mining man toward mining engineers and their ideas. Mine laborers, too, particularly immigrant miners from pre-industrial societies, were hostile to new methods and more efficient machinery that allowed a mine to be worked more profitably with fewer miners. To an engineer, such men were obstacles to progress, not merely to mining, but to civilization as a whole.

Between 1874 and 1876 the number of Raymond's Western editorials declined sharply. In part this was a response to changing conditions in the mining industry. Western gold and silver mining was in decline, while coal and iron activity boomed to such an extent that the Journal expanded by several pages to accommodate it. The changing nature of the editorial page also reflected the increasing editorial participation of Richard P. Rothwell. Rothwell was Raymond's partner in the Scientific Publishing Company, owner of the Journal since 1871. In 1874 he moved from editorship of the coal and iron department to full co-editorship with Raymond. Rothwell had been handling the Journal's business management since 1871, and had turned it into a profitable enterprise. Convinced that the paper was in good hands, Raymond sold it to Rothwell

later in 1874. Although Raymond continued as co-editor, his own interest had changed. Such time as he could spare from his consulting and commissioner's duties, he now devoted to the American Institute of Mining Engineers, and an increasing portion of his editorial writings concerned the Institute and its activities.<sup>57</sup>

Although Raymond credited Rothwell, Eckley B. Coxe, and Martin Coryell with originating the idea for the Institute, his interest in a professional society for mining engineers dated back to his earliest days as Journal editor.<sup>58</sup> Raymond's original purpose in assuming control of the Journal had been to make the publication a kind of clearing house for knowledge useful to the mining industry. He had hoped to make the Journal valuable to trained engineers and practical men alike. By presenting sound information attractively, he thought mining men would educate themselves on an individual basis, thereby improving the entire industry.

Raymond believed, however, that there was also a need for professional men, particularly scientists, to communicate in person. In 1867 he commented on the friction between the American Association for the Advancement of Science (AAAS) and the newly-created National Academy of Science. Raymond thought it was unfortunate that the National Academy was perceived as a threat to the AAAS, since he felt there was a place for both. Raymond saw the National Academy as an elite body intended to advise the federal government in scientific



matters, and he supported it in that role. The AAAS on the other hand was the "large, working association" necessary to bring scientists together. "The great benefit of these meetings," he wrote, ". . . is really the bringing together of men who are engaged in a common pursuit, love that pursuit and thus have an opportunity for private conversation and consultation."<sup>59</sup>

Raymond also recognized the potential of such an organization for political action. In 1868 the Grant administration, in a blatant display of spoils politics, awarded directorship of the Philadelphia mint to Pennsylvania's governor. Raymond accused Grant of cowardice in the appointment and added ruefully,

. . . we wish that the science of the country had risen in time to demand this place, not for an office-seeker, but for some man whose education and experience had qualified him . . .

Unfortunately, Raymond noted, the scientific community was sadly disorganized and the politicians had the position filled "before the country knew it was empty."<sup>60</sup>

If the disorganization of the scientific community at large concerned Raymond, he was actually alarmed at the condition of his own profession. By 1869, rampant litigation in the mining industry had caught up mining engineers in the controversy of "courtroom mining"--paid expert testimony. Some prominent engineers steadfastly refused to have anything to do with courtroom work. Even Raymond, who later was among

the most highly paid witnesses, had reservations about the practice, if for no other reason than the divisiveness it introduced into professional relationships.

. . . there is nothing that disturbs the coolness of professional observers like the knowledge that money is dependent upon the views they take of some knotty questions. Men who, if left to themselves, would modestly compare their opinions with those of their brethren, become, as fee witnesses upon the stand, dictatorial, didactic and obstinate. . . . People often wonder "why the geologists can't agree." Because, gentlemen, you pay them well to magnify and perpetuate their disagreements.<sup>61</sup>

Raymond also was in a dilemma over safety conditions in the mines. He had steadfastly opposed government interference in the industry, but it had become apparent that mining capitalists were not likely to improve the situation if left to themselves. In a December 1869 editorial he reminded his fellow engineers of their grave moral responsibility in the area of mine safety and called on public opinion to force improvement in hazardous mines.<sup>62</sup>

Courtroom mining and safety considerations aside, by 1870 Raymond had completed two tours of the West. What he saw there both in the industry and in the profession disturbed him. The practical mining man still held sway over the Western mines and mills. The "counting room mining superintendents" and mill men ignorant of chemistry still wrought destruction on mining enterprises. Moreover, the reputation of trained professionals still suffered at the hands of self-styled "mining professors" who roamed from

district to district preaching nonsensical (and often harmful) techniques and processes. Mining engineers themselves endured many hardships on the frontier, not the least of which was isolation--physical, social, and professional. An engineer was often the only educated, cultured individual in a mining camp, if he was fortunate enough to be in a settlement at all. An engineer's education was, in a sense, a static asset, and it was difficult to keep abreast of the latest developments in mining practice and technology--even with the Engineering and Mining Journal at hand. No doubt Raymond considered himself fortunate: he had been spared a career in such places. Yet the remote mines of the West were the first rung on the professional ladder for most young engineers. Clearly, something needed to be done for these "brethren" as Raymond called them.<sup>63</sup>

That the idea of a professional association was on Raymond's mind was obvious when he wrote the editorial "Associations of Engineers" in March 1870. He lamented the difficulty of maintaining an engineers' association: "They languish, die, or run into the hands of a few men, who . . . carry the burden of the whole." The problem, Raymond felt, was in the nature of their work. Engineers, he wrote ". . . are all engaged in business, and a kind of business, too, in which there is keen competition and rivalry." It was simply unrealistic to expect competing engineers to sit down together and reveal their professional secrets. However, Raymond

thought it could be done. He pointed to the military engineers, who "make common stock of their experiments, investigations and designs . . . except when the interests of the service require such matters to be kept as confidential." While he was realistic enough to understand that engineers were not likely to achieve the "professional communion" of clergymen or physicians, he thought that it was possible "to redeem the profession from a spirit which, we think has been carried farther than enlightened self-interest even would require."<sup>64</sup>

The American Institute of Mining Engineers was established on May 16, 1871. It had as its stated object:

(1) To promote the arts and sciences connected with the economical production of the useful minerals and metals, and the welfare of those employed in these industries, by means of meetings for social intercourse and the reading and discussion of professional papers and (2) to circulate, by means of publications, among its members and associates, the information thus obtained.<sup>65</sup>

From the very first Raymond took an active role and the Institute flourished. Mining engineer T. A. Rickard credited Raymond's presence in the Institute with attracting large numbers of Western members.<sup>66</sup> In 1875 Raymond himself pointed with pride to the role of the Engineering and Mining Journal in unifying his profession:

The very origin of the Institute, as its founders will confess, was the result of that common feeling which the endeavors of the Journal had aroused among the mining engineers and metallurgists of the country.<sup>67</sup>

ENDNOTES

<sup>1</sup>Engineering and Mining Journal 81 (31 March 1906):611.

<sup>2</sup>A. S. Dwight Interview, Engineering and Mining Journal Historical File, McGraw-Hill Corporate Archives, 29 May 1925, New York, New York. (Typescript.); Engineering and Mining Journal 81 (31 March 1906):612.

<sup>3</sup>Engineering and Mining Journal 4 (21 December 1867):392.

<sup>4</sup>Ibid., 6 (11 July 1868):24.

<sup>5</sup>Ibid., 6 (15 August 1868):104; Rossiter W. Raymond, Statistics of Mines and Mining in the United States and Territories of the Rocky Mountains: Report of the Commissioner for 1868 (Washington, D.C.: Government Printing Office, 1869), p. 6.

<sup>6</sup>Engineering and Mining Journal 6 (11 July 1868):24.

<sup>7</sup>Ibid., 8 (13 July 1869):21; Raymond, Statistics: 1868, p. 5.

<sup>8</sup>Engineering and Mining Journal 14 (29 October 1872):281; Ibid., 4 (28 September 1867):200; Ibid., 4 (9 November 1867):296; Ibid., 7 (13 February 1869):104.

<sup>9</sup>Ibid., 4 (9 November 1867):296.

<sup>10</sup>Ibid., 6 (24 October 1868):264; Ibid., 6 (17 October 1868):248.

<sup>11</sup>Ibid., 6 (24 October 1868):264.

<sup>12</sup>Ibid., 6 (7 November 1868):296.

<sup>13</sup>Ibid., 7 (13 February 1869):104.

<sup>14</sup>Ibid., 11 (16 May 1871):313.

<sup>15</sup>Ibid., 11 (7 March 1871):153; Ibid., 15 (7 January 1873):9.

<sup>16</sup>Ibid., 4 (28 September 1867):200.

<sup>17</sup>Ibid., 11 (7 March 1871):153; Ibid., 10 (6 December 1870):361; Ibid., 11 (28 February 1871):137.

<sup>18</sup>Ibid., 21 (3 June 1876):533-534.

<sup>19</sup>Transactions of the American Institute of Mining Engineers (AIME) vol. 48, p. 301.

<sup>20</sup>Engineering and Mining Journal 10 (20 December 1870):393.

<sup>21</sup>Ibid., 6 (9 December 1868):392.

<sup>22</sup>Ibid., 11 (10 January 1871):25; Ibid., 6 (21 November 1868):328; Ibid., 7 (20 March 1869):184; Transactions of the AIME vol. 48, p. 299.

<sup>23</sup>Engineering and Mining Journal 10 (20 December 1870):393; Ibid., 11 (21 February 1871):121; Ibid., 14 (6 August 1872):89; Transactions of the AIME vol. 48, p. 299.

<sup>24</sup>Engineering and Mining Journal 8 (14 September 1869):169; Ibid., 8 (28 September 1869):201; Ibid., 9 (8 February 1870):89; Ibid., 13 (4 June 1872):361.

<sup>25</sup>Ibid., 13 (11 June 1872):376.

<sup>26</sup>Ibid., 4 (21 December 1867):392.

<sup>27</sup>Ibid., 5 (4 January 1868):8; Transactions of the AIME vol. 1, p. 134. ?

<sup>28</sup>Engineering and Mining Journal 9 (15 February 1870):105; Ibid., 16 (8 July 1873):325.

<sup>29</sup>Ibid., 13 (4 June 1872):361.

<sup>30</sup>Ibid., 7 (17 April 1869):248.

<sup>31</sup>Ibid., 11 (24 January 1871):57.

<sup>32</sup>Ibid., 11 (2 May 1871):281.

<sup>33</sup>Ibid., 14 (10 December 1872):377.

<sup>34</sup>Ibid., 14 (12 November 1872):313.

<sup>35</sup>Ibid., 6 (17 October 1868):249.

For a detailed account of Hayden's career see William H. Goetzmann, Exploration and Empire: The Explorer and

Scientist in the Winning of the American West (New York: W. W. Norton and Company, 1978.)

<sup>36</sup>Ibid., 10 (25 October 1870):265.

<sup>37</sup>Ibid., 14 (12 November 1872):313.

<sup>38</sup>Ibid., 13 (4 June 1872):362; Ibid., 16 (22 July 1873):56; Ibid., 16 (14 October 1873):243.

<sup>39</sup>Ibid., 20 (24 July 1875):74.

<sup>40</sup>Ibid., 21 (29 January 1876):102.

<sup>41</sup>Ibid., 9 (15 March 1870):169.

<sup>42</sup>Ibid., 27 (15 March 1879):179; Ibid., 31 (19 March 1881):191.

<sup>43</sup>Ibid., 8 (19 October 1869):249.

<sup>44</sup>Ibid., 9 (22 March 1870):193; Ibid., 19 (17 April 1875):265.

<sup>45</sup>Ibid., 13 (4 June 1872):361.

<sup>46</sup>Ibid., 12 (1 August 1871):73.

<sup>47</sup>Ibid., 6 (7 November 1868):296; Ibid., 8 (16 November 1869):312-313; Ibid., 7 (8 May 1869):296.

<sup>48</sup>Ibid., 15 (25 March 1873):185-186.

<sup>49</sup>Henry Ward Beecher in the New York Times, 30 July 1877, cited by Paxton Hibbin, Henry Ward Beecher, An American Portrait (New York: Doubleday and Company, 1927), p. 326.

<sup>50</sup>Engineering and Mining Journal 10 (8 November 1870):298.

<sup>51</sup>Ibid., 9 (22 March 1870):185.

<sup>52</sup>Ibid., 10 (22 November 1870):329; Ibid., 8 (17 August 1869):99; Ibid., 13 (19 March 1872):185; Rossiter W. Raymond, Statistics of Mines and Mining in the Territories West of the Rocky Mountains: Report of the Commissioner for 1869 (Washington, D.C.: Government Printing Office, 1869), p. 54; A. S. Dwight Interview, 29 May 1925, Engineering and Mining Journal Historical File, McGraw-Hill Corporate Archives, New York, New York. (Typescript.)

<sup>53</sup>Engineering and Mining Journal 7 (17 April 1869):248; Ibid., 11 (13 June 1871):377; Ibid., 8 (28 December 1869):407.

<sup>54</sup>Ibid., 17 (4 April 1874):213.

<sup>55</sup>Ibid., 7 (13 February 1869):104.

<sup>56</sup>Ibid., 7 (6 February 1869):88.

<sup>57</sup>Ibid., 11 (9 May 1871):297; Ibid., 21 (11 March 1876):245; Ibid., 107 (18 January 1919):136; Ibid., 71 (20 April 1901):486-487.

<sup>58</sup>Ibid., 4 (2 November 1867):280; Ibid., 11 (9 May 1871):297.

<sup>59</sup>Ibid., 4 (31 August 1867): ??; Ibid., 8 (12 October 1869):232.

<sup>60</sup>Ibid., 7 (24 April 1869):264.

<sup>61</sup>Ibid., 8 (17 August 1869): 105; Clark Spence, Mining Engineers and The American West: The Laceboot Brigade, 1849-1933 (New Haven: Yale University Press, 1970), Chapter 6.

<sup>62</sup>Engineering and Mining Journal 8 (28 December 1869): 407.

<sup>63</sup>Ibid., 5 (4 January 1868):68; Ibid., 6 (8 August 1868):88; Ibid., 12 (14 November 1871):313; Ibid., 13 (30 January 1872):72; Clark Spence, Mining Engineers, pp. 122-128.

<sup>64</sup>Engineering and Mining Journal 9 (15 March 1870):169.

<sup>65</sup>Ibid., 19 (8 May 1875):328.

<sup>66</sup>Ibid., 21 (11 March 1876):245; T. A. Rickard, ed., Rossiter Worthington Raymond: A Memorial (New York: American Institute of Mining Engineers, 1920), p. 11.

<sup>67</sup>Engineering and Mining Journal 19 (2 January 1875):4.



## CHAPTER FOUR

### A LITERARY VEIN: FICTION AND TRAVEL WRITING

Throughout Raymond's writing career, it was clear that his was not a purely technical style. Whenever the opportunity arose, Raymond indulged in a highly descriptive literary prose. Later in his career he acknowledged the dual attractions of science and literature, describing them figuratively as the differing demands of wife and mother-in-law. Raymond's "mother-in-law" muse required accounts of "the mines and works, the industries, investments and resources," while the "wife" desired "a pen-sketch of the sunsets, scenery, society, speeches, and sparkling and succulent sundries . . ."<sup>1</sup>

Fellow editor T. A. Rickard believed that Raymond's literary ability was partly inherited from his father, Robert Raikes Raymond, who had been a newspaper editor, English professor, and principal of the Boston School of Oratory. This, along with his exposure to the entire highly-literate Raymond-Howard clan no doubt had an effect, as did his family's friendships with prominent authors. Raymond himself attributed his pursuit of literary goals to New York Times

editor Henry J. Raymond (no relation), who hired Raymond as a foreign correspondent at Freiberg. He also received important experience in 1863 when he translated Jessie Benton Fremont's Story of the Guard into German.<sup>2</sup>

Not surprisingly, in the course of his long career Raymond frequently gave free rein to his literary impulse, producing children's stories, poetry, magazine articles, short stories, and a novel. Much of his early literary output was financially motivated, a means of bringing in additional income for the struggling American Journal of Mining. However, Raymond continued his creative writing after his prosperity was assured. During the period 1868-1876, his literary work, like his scientific writing, reflected his Western experiences.

Raymond's association with Western literature had its roots in his boyhood when he read James K. Paulding's novel Westward Ho!<sup>3</sup> He also knew the works of James Fenimore Cooper, as Leatherstocking was familiar enough that Raymond could compare him at length to Yellowstone guide Gilman Sawtelle.<sup>4</sup> Raymond enjoyed Mark Twain, and frequently quoted him in illustration of Western mining camps and characters. However, he reserved his highest praise for the Western writing of Bret Harte. Raymond knew Harte, for Harte was a contributor to the mining commissioner's annual reports, and many of Raymond's articles appeared in Harte's Overland Monthly. Raymond considered Harte the "author of the best

sketches of California life and manners that have ever made their appearance." Aside from Harte's wit and humor, Raymond admired the author's "truth to nature and good taste." Harte's characters agreed in language and behavior with the Westerners of Raymond's own experience. Calling Harte "one of the brightest heads" of the West, Raymond also praised his editorial skills. The Overland Monthly, wrote the mining engineer, "wisely includes articles on 'material subjects' along with its higher flights."<sup>5</sup>

While he thought Harte best portrayed the developing West, Raymond also admired the writing of Theodore Winthrop, who celebrated the natural beauty of the Pacific Northwest and the romance of frontier adventure. Among the earliest scenic accounts of the West, Winthrop's effusive descriptions were regarded as excessively romantic by critics, reflecting a growing trend toward literary realism following the Civil War. Raymond, however, defended Winthrop, arguing that the "exuberance and extravagance" of Winthrop's work were in fact "faithful reflections of the mood which this wild life inspires."<sup>6</sup>

Winthrop's appeal to Raymond's taste may also be explained in part by the remarkable similarity of their backgrounds. Both were New Yorkers of New England heritage (both, in fact, related to the prominent Dwight family.) During the 1850s, Winthrop worked for the Pacific Mail Steamship Company, a firm with Raymond family connections.

Winthrop also had ties to Fremont, playing an active role in the latter's 1856 presidential campaign. Whatever the appeal, Raymond was often imitative of Winthrop's style, even to the point of naming his 1880 anthology of Western sketches Camp and Cabin, a title evocative of Winthrop's best-selling Canoe and Saddle. Nor was Raymond alone in his admiration for Winthrop's work. According to Thurman Wilkins, Winthrop was Clarence King's "literary hero."<sup>7</sup>

Most of Raymond's Western literature was written between 1869 and 1873. This was a period in which Willard Ward recalled Raymond "sitting up late of night" writing miscellaneous pieces to generate extra income for the Journal. In addition to the small financial reward, Raymond was also motivated by a desire to inform people about the West and its scenic resources. Several such articles were originally lectures (most likely unpaid) at the Cooper Union, Plymouth Church, or New York Geographical Society. Others resulted from Raymond's wish to express views on a topic beyond the Journal's editorial parameters, or to express them to a broader readership.<sup>8</sup>

Raymond's earliest non-professional Western writing, however, was hardly inspired by such serious motives. Beginning in 1868, "filler" on the Journal's editorial page frequently took the form of humorous verse. Occasionally this was the work of recognized authors, such as Bret Harte's "Society on the Stanislaus."<sup>9</sup> More often it was "doggerel"

from the editor's pen. Raymond's rhymes concerned mining themes, but the verse format freed him from customary restraints--the tone was invariably irreverent. In "Jim Green," the tale of a gullible prospector fleeced by speculators, the Western miner was portrayed as a less-than-knowledgeable sort who referred to the mining engineer as "a scientific cuss" and the investor as a "capital sharp." Mining camp dialect (and greed) was also a target:

There ain't a better cow to milk than a first-class mine  
(that ain't a bilk);  
"She'll give you quartz"--and here he cussed--"If that  
ain't level then bust my crust."<sup>10</sup>

The majority of Raymond's Western literature were travel accounts based on his experiences of 1869 and 1871. Some, like "The Ice-Caves of Washington" and "Gray's Peak--To It and Up It" which appeared in the Overland Monthly in 1869 and 1870, were directed almost exclusively at the armchair tourist. These articles extolled the West as a scenic resource and emphasized the novelty and adventure of Western travel. Others, such as the "Canons of the Snake and Columbia" and "Wonders of the Yellowstone," not only described the West's spectacular scenery but also presented the region as a source of scientific knowledge. These articles were originally written for professional audiences: "Canons" was a lecture before the New York Geographic Society in the spring of 1870; much of the material in "Wonders" was intended for Raymond's 1871 commissioner's report.<sup>11</sup>

During the 1870s, Raymond also tried his hand at Western fiction with two short stories, "Thanksgiving Joe" and "Agamemnon," and a novel, Brave Hearts. As with his travel writing, these works relied heavily on the author's own experience in the mining districts of Nevada and California.<sup>12</sup>

While his professional writing largely limited Raymond to a consideration of the West in terms of its material resources, his literary work allowed him a broader focus, one in which the West could be seen in terms of people and lifestyle as well as its landscape.

In writing of the West's people, Raymond dealt only with Westerners he had experienced. His stories (most of his characters occur in his fiction) contain no farmers or Indians. Raymond's characters were frequently "types" rather than individuals, as he depicted in "The Ice-Caves of Washington":

There was a keen and portly Portlander, who cherished a secret intention of . . . creating out of the cave a fashionable ice-watering place. There was a young, enthusiastic tourist from the Mississippi Valley, who, having lived out West until the West was East, had come to explore the veritable Occident. . . . There was a veteran inhabitant, who goes out every spring on snow-shoes, and "claims" the cave, under an ingenious application of mining law, as a mineral deposit, so as to obtain a monopoly of the ice-packing business.<sup>13</sup>

The characters appear throughout the story as the Tourist, the Portlander, the Veteran, and Raymond's persona, the Writer. Miners typically were men of little education who mangled the English language with dialect and profanity. Stage drivers

were experienced, skillful, and daring. Mining engineers were always honest.

Raymond's own prejudices were often visible in his fictional characterizations, most notably his treatment of the O'Ballyhan family in "Agamemnon." The elder O'Ballyhan, although a graduate of Dublin's Trinity College, was an irretrievable drunken failure who "had no conscience." Mrs. O'Ballyhan was "the most utterly negative washed out woman," addicted to pulp novels and opium. Their "keen, energetic straightforward son," the hero of the story, was clearly an exception to his race, "a clear case of . . . atavism--the reappearance, in some remote descendant, of ancestral qualities which are entirely wanting in the intermediate generations."<sup>14</sup> Young O'Ballyhan was typical of Raymond's miners who, like the West itself, needed only the ennobling effect of a civilizing influence (in this case a school teacher) to realize their potential.

While fiction like "Agamemnon" allowed Raymond to portray in detail life on the mining frontier, it was the travel narratives that relayed his view of the uncivilized West. Throughout his travel accounts, Raymond emphasized the natural beauty of the West. But here, as in his professional writing about natural scenery, Raymond did not mask the engineer's utilitarian attitudes.

In "Gray's Peak," Raymond began the narration of a journey up the mountain by scoffing at the idea of the Rocky

Mountains as a barrier between the East and West. The railroad had reduced them to "as much of a barrier as the hole in the fence . . ." And, like the hole "through which one used, in comparative infancy to kiss the little girl . . . next door," the mountains were now "a positive opportunity, an invitation, not a hindrance."<sup>15</sup>

Much of that invitation lay in the region's scenic beauty, but Raymond was not content to simply celebrate the natural setting. He repeatedly imposed man's presence on the landscape, a frequently destructive presence, as on the mountainside "sadly scarred by great fires which the recklessness of the inhabitants occasions . . .", or in the "smoke and fumes from the smelting works [that] supply the cloud . . . lacking in this morning's spotless sky."<sup>16</sup> But more often than not, Raymond portrayed man's presence as he perceived it, as the element which gave purpose and meaning to the scene. In doing so he made even a mine appear as a thing of beauty:

But what is that, a thousand feet up the cliff? A house--ye gods! A boardinghouse! The glass shows us fragments of a zigzag trail, interspersed with ladders, where the precipices are otherwise impassable. Now we see, at the foot of the cliff, another house, and between the two, fine lines, like a spider's web, stretched through a thousand feet of air. That is the somewhat celebrated Steven's Mine . . .<sup>17</sup>

Such portrayals of modern man and his works as inevitable and proper parts of the landscape were not accidental. Raymond was stating his utilitarian philosophy in such scenes, just



as deliberately as he did in his mining editorials. However much Raymond enjoyed writing creatively about the natural beauties of the West, he clearly rejected the earlier 19th century romantic view that the natural condition was the ideal state for man and his resources. Of that Adam-like "state of savage innocence" he wrote, "I can only say that Adam's career was a disgraceful one. He had a better chance than the rest of us, and he ruined himself and his descendants." According to Raymond, Adam's sin was "lolling about and eating the spontaneous fruits of the earth, instead of tilling the garden with industry . . ." So too it was with the Indian. Placed in the Eden of the New World--in this case the American West --he had mismanaged its bounty by allowing it to remain in its natural state.<sup>18</sup>

## ENDNOTES

- <sup>1</sup>Engineering and Mining Journal 25 (8 June 1878):387.
- <sup>2</sup>T. A. Rickard, ed., Rossiter Worthington Raymond: A Memorial (New York: American Institute of Mining Engineers (AIME), pp. 12, 16; Engineering and Mining Journal 72 (17 August 1901):194; Transactions of the AIME vol. 28, p. 767.
- <sup>3</sup>Elizabeth D. R. Bellinger in R. W. Raymond: A Memorial, ed., T. A. Rickard, p. 20.
- <sup>4</sup>Rossiter W. Raymond, Camp and Cabin: Sketches of Life and Travel in the West (New York: Fords, Howard and Hulbert, 1880), pp. 154-155.
- <sup>5</sup>Engineering and Mining Journal 9 (10 May 1870):297; Ibid., 11 (6 June 1871):361; Ibid., 6 (8 August 1868):88.
- <sup>6</sup>Ibid., 12 (12 September 1871):169; Ibid., 7 (28 September 1869):194; Elbridge Colby, Theodore Winthrop (New York: Twayne Publishers, 1965), p. 79.
- <sup>7</sup>Theodore Winthrop, Canoe and Saddle, ed. John H. Williams, XXV, XXVI (Tacoma: John H. William, Franklin-Ward Company, Portland, 1913); Colby, Theodore Winthrop, p. 44; Thurman Wilkins, Clarence King: A Biography (New York: The MacMillan Company, 1953), pp. 37-47.
- <sup>8</sup>Engineering and Mining Journal 81 (31 March 1906):612; Ibid., 10 (9 August 1870):1; Ibid., 10 (16 August 1870):97; Ibid., 107 (18 January 1919):138.
- <sup>9</sup>Ibid., 9 (10 May 1870):297.
- <sup>10</sup>Ibid., 107 (22 February 1919):363.
- <sup>11</sup>Rossiter W. Raymond, Statistics of Mines and Mining in the United States and Territories of the Rocky Mountains: Annual Reports of Rossiter W. Raymond, U.S. Commissioner of Mining Statistics, 1871 (Washington, D.C.: Government Printing Office, 1871), p. 280; Engineering and Mining Journal 10 (9 August 1870):81; Ibid., 10 (16 August 1870):1; Overland Monthly (November 1870), p. 208; Ibid., (December 1870), p. 512.

<sup>12</sup>Raymond, Camp and Cabin, pp. 7-99; Rossiter W. Raymond, Brave Hearts: An American Novel (New York: J. B. Ford and Company, 1873).

<sup>13</sup>Raymond, Camp and Cabin, p. 210.

<sup>14</sup>Ibid., pp. 72-73, 76.

<sup>15</sup>Overland Monthly (December 1870), p. 512.

<sup>16</sup>Ibid., (December 1870), p. 516.

<sup>17</sup>Ibid., (December 1870), p. 517.

<sup>18</sup>Raymond, Camp and Cabin, pp. 215-216.

## CONCLUSION

In 1876, following completion of the previous year's report, Rossiter Raymond resigned as Commissioner of Mining Statistics. Continually frustrated by inadequate appropriations and the refusal of the Government Printing Office to render his documents in a timely fashion, Raymond recommended that the commissioner's appropriation be suspended altogether, until such time as the government could find a way to fund the work properly.<sup>1</sup> (It was eventually merged with the United States Geological Survey.) It was evident that he had lost much of his earlier enthusiasm for the task. After studying current production statistics, and "much personal observation of the principal producing district," he predicted that there would be no new large deposits uncovered without the investment of great amounts of capital.<sup>2</sup> In other words, he did not foresee any major mining booms in the near future. This and the more settled nature of the West had deprived the commissionership of much of its appeal. His editorial correspondence had tapered off during the previous two years, and he wrote fewer non-mining commentaries. In writing of himself in relation to his fellow engineers, Raymond seemed conscious that he was at a turning point:

Standing in some sense between the two classes [veterans and young men], not wholly past the enthusiasms . . . of youth, though partly cooled and disenchanted, nor on the other hand, qualified to speak with the weighty authority of long experience . . . I claim at least the ability to admire and the sympathy to appreciate . . . youth and age, theory and practice, hope and experience, ambition and achievement.<sup>3</sup>

By the mid-1870s, mining consultants were riding the crest of a wave of litigation, commanding high fees for mine inspections and for trial appearances as expert witnesses. By his own estimate Raymond had inspected between five hundred and a thousand mines. His reputation and experience would eventually bring him a fee of \$5000 for a single mine report. Although Raymond legally had combined consulting work with his commissioner's visits, the time spent attending to the commissioner's duties was no longer economically feasible. Not only was the consulting money more attractive, but the lifestyle of paid experts who traveled at company expense was often quite lavish.<sup>4</sup>

By 1876, Raymond was absorbed in his duties at the American Institute of Mining Engineers. Since its beginning in 1871, he had served as president from 1872 to 1875 and was vice-president in 1871 and 1876.<sup>5</sup>

In the years that followed his return to private practice, Raymond distinguished himself as an expert witness in several major mine litigations. In the case that established his courtroom reputation, the Eureka-Richmond decision of 1877, Raymond proposed a concept of a mineral vein

that was eventually adopted by the court and resulted in a broader new legal definition of the term. Raymond also testified, along with his old friend Clarence King, on behalf of the Amalgamated Copper Company during its legendary legal battle with F. A. Heinze in Butte in 1900.<sup>6</sup>

In 1884, Raymond became secretary of the Institute, a post he retained for twenty-six years. In that capacity he worked tirelessly on behalf of his profession, continuing to write prolifically and editing forty volumes of the Institute's Transactions.

When, at the age of seventy, Rossiter Raymond looked back on his career as "interpreter, chronicler, guide and assistant to engineers," he remarked, "Dear friends, that was not my ambition. It was not my dream." He harkened back to the earliest days of his career, beginning with his youthful voyage aboard the Great Western and concluded: "I can now see that I unconsciously obeyed the maxim of Browning: 'Get thy tools ready, God will find thee work.'"<sup>7</sup>

ENDNOTES

<sup>1</sup>Engineering and Mining Journal 103 (28 April 1917):762;  
Ibid., 31 (9 April 1881):245.

<sup>2</sup>Transactions of the American Institute of Mining Engineers vol. 3, p. 204.

<sup>3</sup>Engineering and Mining Journal 19 (29 May 1875):389.

<sup>4</sup>Clark Spence, Mining Engineers and the American West: The Laceboot Brigade, 1849-1933 (New Haven: Yale University Press, 1970), pp. 108, 133, 215.

<sup>5</sup>T. A. Rickard, ed., Rossiter W. Raymond: A Memorial (New York: American Institute of Mining Engineers, 1920), p. 16.

<sup>6</sup>Clark Spence, Mining Engineers, pp. 215, 227-228;  
Engineering and Mining Journal 107 (18 January 1919):140;  
Rickard, ed., Memorial, pp. 10-11.

<sup>7</sup>Charles W. Goodale, ed., Rossiter Worthington Raymond, 1840-1910 (n.p., 1910), pp. 51-52.

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