SWEDENBORG'S CAREER ON THE BOARD OF MINES—THE WORLD OF USES*

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On April 7, 1723 Emanuel Swedenborg was invited to take his seat on the Board of Mines. He had received his commission from King Karl XII on December 18, 1716. For seven years the gifted bishop's son had struggled to have the board, Sweden's most powerful economic institution, recognize the legitimacy of his extra-ordinary appointment. The decision to seat Swedenborg reflects well on both Swedenborg and the board. To understand why, it is necessary to explore the history, the structure, functions, and the personnel of the Board of Mines, as well as Swedenborg's effort to develop competencies in areas related to the work of the board during his years in limbo.

After exploring the history of the Board of Mines, it operational procedures, and the nature of its personnel, as well as Swedenborg's efforts to become a recognized assessor on the board, it is critical to examine Swedenborg's duties and actual activities as an assessor. What did he do on a daily and yearly basis during his twenty-four years on the board, and what contribution did he make to the board and to Sweden in this capacity? With this knowledge and understanding as essential to understand

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the man, his personal development, and expertise, it would then be possible to critically assess the importance of this position for Swedenborg's spiritual development and his role as a revelator and eyewitness to the Apocalypse.

Background—the Governmental Reforms of Gustav II Adolf's Reign

An institution similar to the Bergskolligium or Board of Mines was first envisioned as a key administrative element of the Swedish government in 1630 during the reign of Gustav II Adolf (1594–1632). Gustav II Adolf was a great warrior king who was celebrated as "the lion of the North" during his reign; however, with the collaboration of his Chancellor, Axel Oxenstierna (1583–1654), he also undertook the transformation of Sweden's governmental structures. In the process, a modern state was created that became one of the most efficient and effective in Europe. The sweeping governmental changes enhanced and reinforced Sweden's war-making abilities; and the powerful combination of successful domestic reform and aggressive foreign policy gave rise to Sweden's "Age of Greatness."

The reforms were initiated immediately upon Gustav II Adolf's ascension to the throne. They were established by Gustav II Adolf in partnership with Axel Oxenstierna in the Charter of 1611. Their partnership was to last throughout Gustav's reign. Together they made Sweden one of the great powers in Europe. The partnership developed when Gustav's father suffered a stroke in 1610. Axel Oxensteirna was twenty-seven and a member of the King's council, and Gustav was only a youth of sixteen. While the king was incapacitated, the two young men directed the affairs of state together. Upon the death of the Karl IX (1550–1611) the following year, Oxenstierna took a hand in assuring the selection of Gustav as king. Dynastic issues and Karl IX's autocratic character contributed to the fact that the choice of Gustav was not automatic. Creating a Charter of guarantees played a vital role in securing the position for Gustav. Karl IX had been a tyrant and both the council and the Riksdag had grievances. They would not swear loyalty to Gustav Adolf until they were assuaged. The Charter was negotiated and contained thirteen articles. The form of government it specified had both old and new elements in it. On the surface, it

seemed to guarantee a return to rule by council, while it actually set the stage to recast the constitutional structure. The king was to consult with his Uncle Duke Johan, the council, and the Estates. It preserved Sweden's Lutheran faith and the Riksdag, but the Estates were no longer even nominally part of the decision making process, as increased power was granted to the nobility.

In signing the Charter in January of 1612 Gustav II Adolf was immediately accepted as king; however it required him to renounce many of the prerogatives exercised by his father (Scott, 1988, 164). Over time this mattered little, because of the force of his personality and the quality of his actions. He was blessed with extraordinary talents and had a commanding presence; thus, what he gave up on paper, he more than gained in practice. His close partnership with Oxenstierna, whom he named Chancellor two days after signing the Charter of guarantees, complemented his own abilities, and in the end he had more power than his father, the tyrant (Scott, 1988, 164). Nonetheless, the system of government that emerged under Gustav II Adolf was based upon "the principles of delegation of royal authority, regulation of procedures, and centralization of administration" (Roberts, 1973, 85).

Reforms were instituted from 1612 onward. Ordinances in 1614 and 1615 created Sweden's first supreme court. It was to hold sessions in Stockholm during five months of every year, and it was presided over by a high steward, four members of the council, and nine assessors, five from the nobility and four commoners. They were bench judges and the decision was reached by majority vote (Roberts, 1973, 85).

In 1618 the Treasury was also redesigned; it was presided over by the treasurer, one of the five great officers of the state—the others being the high steward, the marshal, the chancellor, and the admiral. The aim of the reorganization was centralization, particularly of accounting and auditing. The treasurer was to work with a board and the decisions were to be made collectively. The office was guided by specific regulations and requirements and it functioned somewhat like a department. The organization facilitated financial planning, and "in 1623 it produced the first statement of national accounts" (Roberts 1973, 86). The development of financial transparency and efficiency were vital to Sweden given the ongoing challenge of belligerent neighbors and minimal resources.

The Chancery was constructed by Oxenstierna to be the center of government—it translated the royal will into action. Two Ordinances spelled out the duties of the office, and outlined the rules of compensation for the staff, one in 1618 and, another in 1626. Initially Oxenstierna was reluctant to have a collegial board similar to the Treasury; however, in 1626 when he was named Governor in Elbing, Prussia, he realized the work of the chancery must go on whether or not either he or the king were resident in Stockholm to oversee it activities, so he constructed the office as a *collegium*. The success of this reorganization led Oxenstierna to implement the collegial system in all areas of government. In 1630 the college of war was established under the marshall, and a naval college was implemented under the admiral. In both cases, executive and judicial powers were combined within each college.[1] Oxenstierna also envisioned other collegial institutions, such as commerce, mining, the church, and education. Reforms in these last two areas, however, were defeated by the clergy, zealously guarding their preserve from lay involvement.

Nonetheless, by the time of Gustav II Adolf's death on the battlefield of Lutzen, the collegial system of government had been clearly established in Sweden. This system was reaffirmed by the Forms of Government outlined in 1634. According to Michael Roberts:

> [It] sums up the administrative innovations of Gustavus's reign. Colleges, council, and regents were not intimately linked;[2] the council became a body of civil servants; the old demand of the nobility for a direct share in government was realized. At the same time, the expansion of a regular civil service opened a career to talents and quickened the pace of social mobility. Socially, no less than administratively, the Form of Government heralded the coming of a new age. Among other things, it made

[1] In adopting a system of government organized in colleges, Oxenstierna instituted the vision of Erik Sparre (1550–1600), the Swedish Chancellor who was executed by Karl IX in the Linköping bloodbath. He was accused and convicted of treason because he actively supported Sigismund, King of Poland and pretender to the Swedish crown.

[2] In 1625, the regents were no longer viewed as specific individuals but were entrusted to the council as a whole. See Michael Roberts, *Gustavus Adolphus and the Rise of Sweden* (London: The English University Press, 1973), 90.

> Stockholm indisputably a capital city; for except when there should be an outbreak of plague, the central government was now forbidden to leave it (Roberts, 1973, 88).

The statute that elaborated the Forms of Government arrived in Stockholm only eight days after the King had fallen in battle. Sent by Oxenstierna, it is not known whether or not Gustav had approved the document. It contained sixty-five articles touching on almost every aspect of government, including oversight of mining. It established a structure and procedure for everything. It also elevated the Riksdag's role in governance, by making its resolutions binding law that could be altered only by another Riksdag. This included the power of taxation. New taxes required the consent of both the monarch and Riksdag because together they "'constitute the sovereign authority of the realm'" (Roberts, 1973, 96). Perhaps of equal importance, given the circumstances at that time, it spelled out the machinery needed to govern in the absence of the king or during the minority of a monarch. Superintending the regency was the chancellor, who governed by presiding over a five-person council. While the forms of government set the broad framework for Sweden's governance well into the future, it is interesting to note that that neither Queen Kristina nor subsequent monarchs ever formally adopted the document (Scott, 1988, 187).

The Board of Mines

Gustav II Adolf sought to reform the government of Sweden in order to make her more secure. Not long before he left for the war in support of the Protestant cause in 1630, he wrote a letter in which he identified the need to create something akin to the Board of Mines which he called the *Bergsamt.* His desire to establish this agency was also with the security of Sweden in mind. It was clear to him that centralizing oversight of all the mining actives in the nation would stimulate production and increase quality and thereby benefit the nation. The wealth generated could be used to fund the war effort and increase the material prosperity of the nation. In comparison to the countries of continent Europe, Sweden was

poor. Tapping into the great stores of copper and iron, Sweden's buried treasure, could change the equation. The structure of the *Bergsamt* was fully developed in 1634 and it became operational in 1637, at which time the name was changed to *generalbergsamet*; in 1649 the name of this administrative board was officially changed to *Bergskolligium*.[3] One event that pressed the government to follow through on authorizing the board was a major landslide at the Great Copper Mine in Falun in 1635 (Almquist 1909, 10). Stricter regulation could both minimize the occurrence of cave-ins and deal more effectively with the aftermath should one occur.

Svante Lindqvist in his work *Technology on Trial* (1984) describes the Board of Mines as the department of government empowered to oversee, regulate, and control the mining industry. The creation of this authoritative body "'ushered in a new era in Swedish mining history. Henceforth, the Government was to have mining under effective control'" (Lindqvist 1984, 95). Oxenstierna approved the plan for a governmental agency that would "consist of experienced and skilled men who would oversee and inspect all the newly created and old mining establishments and activities in the kingdom. It would direct and enforce mining [procedures] concerning: quarrying, smelting, blasting, and milling" or any business related to mining (Almquist 1909, 11).[4] The *Riksråd* or Council of State gave its approval in November of 1636, and not long after, on February 14th 1637, Queen Kristina issued a memorial authorizing the new government department (Almquist 1909, 11).

Unquestionably the seventeenth and eighteenth centuries constituted the great age of Swedish mining. Copper was one of Sweden's major exports in the seventeenth, and by the early eighteenth century iron had overtaken it and become her major export, accounting for seventy percent of the total. Despite knowing these facts, Lindqvist states, the actual role

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[3] In fact, from the beginning, the Board of Mines was organized like a *kolligium*. Svante Lindqvist, in *Technology on Trial* 1984, writes that: "The Swedish Collegia were government agencies in which a matter was dealt with by several persons at once (as distinguished from modern systems under which a decision is made by an civil servant on behalf of his department," (95). In this essay, the titles College of Mines, and Board of Mines will be used interchangeably.

[4] All the material from Johan Ax. Almqvist's book *Bergskollegium och Bergslagssttsterna 1637–1857*, Stockholm: Norstedt & Sonner, 1909 was translated by the author, Jane Williams-Hogan.

played by the Board of Mines in developing and sustaining the Swedish mining industry during this period cannot really be assessed because the history of the board has never been written. He calls "this an unfortunate lacuna in [Swedish] historiography, as the history of the private ironworks is comparatively well documented. This imbalance gives an inadequate picture of the influence of the state on private industry" (Lindqvist 1984, 96).[5]

Karl-Gustav Hildebrand in his work *Swedish Iron* (1987) describes the board as a powerful, high status institution, and suggests that it was a cross between a subordinate branch of the government administration and an actual Ministry of Mines. The first presidents of the board were members of the Council of State. In fact Carl Bonde, the first president (1637–1652), helped to develop board policies. He had worked most of his life in mining administration in one capacity or another. Thus, it was quite natural that as a trusted member of the council, he would become intimately involved in the creation of the statues that fixed the duties of the board. Also it is interesting to note that, according to a 1633 letter, he had been designated governor all of Sweden's mines and forges even prior to Gustav II Adolf's death (Almquist 1909, 11). The next president, Erik Flemming (1652–78), was reported to be one of Sweden's most competent and effective administrators during the seventeenth century. The board stands out during this period as a remarkable institution staffed by men with administrative expertise and a genuine grasp of mining practices at the local level (Hildebrand 1987, 120).

Bond himself named the first four assessors who, as specified in the statues of the board, must be nobles. To this group were adjoined an accountant, a steward, a secretary, a supervisor of mining machinery, and a mineral surveyor. The number of assessors became six in 1649, and it was specified that one of them must permanently reside in Stockholm. The rest of them could be county governors in the mining districts. In the early days of the board, the county governors at the Great Copper Mine in

[5] While it is true that no history of The Board of Mines has yet been written, even since Lindqvist made his observation in 1984, the impact of board decisions on limiting the production of iron in 1750 is well documented. Absent a full history of the board, a discussion of this policy shift could perhaps shed light on the effect of board policies prior to that date.

Dalarna, Västmanland, Närke, and Värmland had almost total control over the mining activities in their respective provinces and once a year they would come together at the Bergskolligium to collectively conduct business. This arrangement was discontinued in 1699 (Meijer 1904, 1494).

Once established, the Board of Mines had power over all the mining operations and activities connected in any way with mining. On a day-to-day basis this entailed the creation of regulations, writing statues, detailing privileges, and making decisions. Collectively these were know as the "mining statues" or *Bergsordingar*. While statues had been written prior to the creation of the board, the number issued dramatically increased after its establishment. In fact, between 1637 and 1716 when Emanuel Swedenborg was first appointed to the board as an extra-ordinary assessor by Karl XII, the board averaged issuing about four mining statutes per year (Lindqvist 1984, 97). That number increased during Swedenborg's tenure on the board (1716–1747) to approximately fifteen statues per year or almost four times the number.[6]

During the seventeenth and early eighteenth centuries the board underwent several organizational changes. Its composition in 1649 consisted of a Governor, who should be a councilor of state, and six assessor, who all must be nobles. One assessor must reside in Stockholm, while the others could also be governors of mining regions. This arrangement did not last very long. In 1651 the title of "governor" was replaced by "president." Not long after that changes took place, which after some time became the rule. These changes resulted in having a president of the College of Mines and two assessors who must work together. This required that they all live in Stockholm. The salary was also increased from 600 to 900 d. s. m.[7]

Over the next twenty years or so, there was flux both in the number of assessors and their salaries, as well as the specific titles and number of additional employees at the College of Mines. There were employees who

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[6] This figure is based on a chart found in LIndqvist figure 5.5 on page 103. Lindqvist reports that from 1735–1775 the number was twenty-three per year. This represents the highest number of statues issued by the Colligium when compared to any other period of Swedish history, and it covers twelve years of Swedenborg's career on the board overseeing mining operations in Lapland and Finland.

[7] d. s. m. refers to Swedish coinage dalars silver mynt; Sweden also had dalars koppar mynt, a currency of less value.

were later given the title of "auskultantar"; they were like apprentices and they received half salary. In the 1670s a number of extra-ordinary assessors were named. They served without pay, but could eventually take the place of an ordinary assessor. This system did not last very long, and after 1675 only three extra-ordinary assessors were ever named to the board (in 1684, 1716, and 1738). Emanuel Swedenborg was the extra-ordinary assessor named in 1716.

The Royal College of Mines 1720

In 1720, not long after Swedenborg was appointed to the Board of Mines, its organizational structure assumed the form it would have for the next thirty years. The full work of the College of Mines was accomplished by approximately ninety individuals, almost thirty of whom were located in Stockholm. This included the executive division and nine other other areas. The executive consisted of a president, two councilors, and four assessors.[8] The other nine areas were: *Kansliet* (Secretariat) with four members; *Fiskalämbetet* (Prosecutor's Office) with two; *Kammarkontoret* (Treasurer's Office) with two; and *Notariekontoret* (Trust Department) with two; an *Arkivet* (Archive) with an archivist; a *Proberkammaren* (Assayer's Office) with one assayer; *Ingenjörsstaten* (Engineer's Office) with three; a *Laboratorium chemicum* (Chemical Laboratory) with four, and a *Loboratorium mechanicum* (Mechanical Laboratory) with a Director and two mechanics with stipends (Lindqvist 1984, 98).

At the local level, Sweden was divided into eleven mining districts, called *Bergmästaredömen*, covering all the areas of Sweden where there was mining, including Lapland and Finland. The largest of these districts were numbers one and two which represented the Great Copper mine in Falun, and the Sala Silver mine, and numbers ten and eleven. District two had nine employees and District one had six; while the smallest, Lapland and Finland, Districts ten and eleven, had only one each (Almqvist 1984, 100-101).

[8] While the structure created in 1520 stated that there should be four assessors; from 1715–1725 there were, in fact, five.

The third category of officials was the *Auscultators* or apprentices.[9] These were unpaid positions available for young men interested in the mining industry. To make a career as an official in the Swedish mining industry, it was first necessary to be appointed as an apprentice. These apprentices could work either in the central administration in Stockholm or in the various mining districts. Only about one half of all the applicants were accepted. Between 1715 and 1725 approximately four were accepted yearly, with the number in service at any one time around fifteen (Almqvist 1984, 101).

Almqvist, in his book *Technology on Trial,* sketches the career of an average board of mines official. Such a young man attended Uppsala University until he was twenty and then made a successful application to become an auskultant. He then worked either in Stockholm or in one of the mining districts for a few years, before it was possible for him to travel at the board's expense to study the mining industry in Europe. When he returned, he was appointed to some minor position with the board again, either with the central administration or in the mining districts. Promotions were slow in coming and by the age of thirty-five, he could be appointed a mining inspector. After serving in that position or a similar one, he could perhaps become an assessor at the age of forty-three. The average length of time it took to become an assessor was twenty-three years, according to Lindqvist. Once an assessor, he would remain at that position for ten years or so, before being appointed a Mine Councilor, a position generally held for another ten years, either dying in office or retiring after another ten years. Thus the average member who reached the position of assessor had served the board for approximately forty years (Almqvist 1984, 101).

Given the importance of the mining industry to the wealth and welfare of Sweden, it is not surprising that experience was the key necessary for promotion and tenure within the board, particularly for promotion to the executive arena and the exercise of executive authority. Thus, the board itself was not enthusiastic about extra-ordinary appointments made

[9] The Swedish for Auscultator (Linqvist's translation) is Auskultanter (plural). Therefore, when I refer to one apprentice, I use the word auskultant.

by other governmental agencies, or even by the King, to the board without its consent. The board jealously guarded its independence and its right to appoint its own members. In its 1720 reorganization, it was stated that all the members of the board should be:

> such, who by experience have made themselves suitable for Judicial Office and have also gained all the necessary and thorough knowledge of all that concern the mining industry with regard to production and to the financial administration of the mining districts. (Almqvist 1984, 102)

While this did not suggest that the standards were raised, it did mean that it was important for the board to adhere to its standards. The impact of this re-statement or emphasis on appointment requirements had particular consequences for Emanuel Swedenborg.

Swedenborg's Appointment 1716–1724

Appointed in 1716, Swedenborg was first seated in 1717, and soon afterward he asked for a leave of absence to work on projects with Christopher Polhem (1661–1751). After the death of King Karl XII in November of 1718, Swedenborg was ennobled on May 23rd 1719 (a requirement for full participation on the board), and he attended several board meetings in November of that year. No doubt he attempted to garner support by discussing his recent experiences working with Polhem—he had, in fact, sent descriptions of this work to the board, while it was underway. In addition, it is possible that he showed some of the board members copies of *Daedaleus*, or other articles he had written.

Whatever he did, it must have had some effect, because in December, on the 21st, he was sworn into office again. The minutes for the Royal College for that date, note: "Mr. Emanuel Swedenborg entered and was sworn into office" (Lindqvist 1984, 161). One wonders why it was necessary for him to be sworn in a second time. Lindqvist speculates that perhaps it was because he had gained some experience working as Polhem's assistant, or because of his publications on blast furnaces and/or increasing the efficiency of title stoves (a subject of great interest to the board

during the eighteenth century).[10] While initially nothing changed substantially for Swedenborg, the board may have decided to recognize his extraordinary appointment because it did not involve a outlay of funds; and they may have been impressed enough to envisioned that Swedenborg might be of some use to them in the future, given the shifting political winds with Fredrik I (1676–1751) soon to be crowned king. In any case, since there were no vacant ordinary seats, at the time there was little cost in recognizing him.

As we have seen, this situation was to change dramatically over the next two years. The position of vice-president disappeared, and three seats became open due to the deaths of board members. Swedenborg had attempted to cultivate a relationship with Hjärne, no doubt due to his father's relationship with him; his leaving the board negated any potential political benefit for Swedenborg.[11] The president, of course, would be a man of impeccable credentials, and Gustaf Bonde, who had been a commerce councillor and a governor, fulfilled that requirement. Swedenborg lost no opportunity to gain his notice and respect; soon after Bonde's appointment, he dedicated his *Miscellaneous Observations,* Vol. I (Leipzig 1722) to him.

One of men who died in 1720 was Councillor Robert Kinninmundt (1647–1720). He had been as assessor for thirty years and a councillor for seven at the time of his death. He was replaced by Anders Strömner (1746-1730), a man with similarly long service related to the board. He had been named assessor in 1699, and had been retired from that position ostensibly due to old age. However, he was named an extra-ordinary councilor in 1719. Thus, while it is somewhat surprising that he was called back into service (perhaps due to the change in government), he was logically the next person to fill the councilor's position.

The other position was filled by Johan Bergenstjerna (1668–1748), a long standing mining official who had been named an assessor in 1719,

[10] Although it should be pointed out that Swedenborg did not publish on those topics until 1722 in the first volume of *Acta Literaria Svecia.*

[11] Swedenborg's relationship with Hjärne was complicated by the fact that a public dispute had arisen between Bishop Jesper Swedberg and Unban Hjärne over Swedish orthography. So Hjärne's leaving the vice-presidency may have actually been more of a benefit to Swedenborg than a hindrance.

and who now took his seat as an ordinary assessor in June of 1720. His appointment fit the new, more stringent, requirements of the board, and was therefore not surprising.

The appointment of Dr. Magnus Bromell, however, was a surprise to Swedenborg and perhaps others. Particularly, since the appointment of Bergenstjerna, on paper, provided the board with its full complement of assessors (four). It should be pointed out that at the time, Anders Svab was also an assessor, but in name only, because he currently filled the position of Mining Master at the Great Copper Mine in Falun. Bromell was Hjärne's assistant in the chemical laboratory under the board's supervision and control. And Hjärne, although no longer vice-president, was still the director of the laboratory. Perhaps, Bromell's appointment was part of a "deal" the board made with Hjärne when he accepted the college's decision to eliminate the position of vice-president. This is completely possible because Hjärne stepped down on October 20, 1720 and Bromell was appointed a month later, on November 25th. What the foregoing discussion illustrates is the reality that close relationships and political decisions, as in so many organizations, played important and significant roles at the Royal College of Mines.

Despite being sworn in, Swedenborg was still not considered a full-fledged member of the board, and his 1720 application to fill the vacancies discussed above were denied. Thus, while he wrote to the board, it seems that he did not attend any board meetings during 1720.

In 1721 he again wrote to the board, this time informing them of his plans to travel to Europe to study the mining industry. While his letter stated that he wished to go abroad to study the business of mining, Swedenborg also planned to go to Amsterdam to publish several manuscripts he had been working on.[12]

He left Sweden in May of 1721 with his cousin, John Hesselius (1687–1752) who was going to Holland to study medicine. Before Swedenborg left, he wrote an article in response to one by the celebrated Jacob a Melle, in which Melle had cited his work *Height of Water* (1719). Swedenborg's response was published in *Acta Literaria Sveciae* (July–September 1721).

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[12] Prior to 1720, in addition to the six volumes of *Daedaleus*, Swedenborg had published several small pamphlets and a 136-page *Algebra* or *Regel-konsten.*

His first stop abroad was Amsterdam where he published anonymously three works: *Chemistry and Physics* (203 pp.); *Iron and Fire* (56 pp.); and *Finding Longitude* (55 pp.). All these works were positively reviewed in the premier learned journal of the day, *Acta Eruditorum*. He traveled to The Hague where he had also taken the opportunity to visit with Joakim Frederick Pries (1667–1759), a long-standing friend from his first trip abroad. He traveled to Leiden in order to visit the University and to consult with professors, particularly Dr. Boerhaave. He also took the time to write several additonal articles for publication; some he sent home to Sweden and others he planned to publish during his trip.

He met his cousin again in Amsterdam, and they traveled to Aix-la-Chapelle to experience the varied geography of the area, before going to Liege for Christmas. He parted with his cousin soon after the holiday and made his way eastward to Leipzig. There he settled in to publish some of the additional observations he had made, including the 179-page work was titled *Miscellaneous Observations,* Vol. I which, as was noted, he dedicated it to Count Gustaf Bonde, the new President of the Royal College of Mines.

He journeyed to Brunswick and was hosted by the the duke and his brother, Ludwig Rudolf, who encouraged him to visit the Hartz Mountain mining region that the duke owned. Delighted by this offer Swedenborg went there, examined the mines, and proceeded to write up some of his investigations. He published these in Schiffbeck as volume II of *Miscellaneous Observations*, 56 pages, and dedicated the book to Duke Ludwig Rudolf.

During this trip he had acquired a much deeper knowledge and appreciation of mining, particularly how to smelt ores. In his enthusiasm, he had a prospectus printed for a book that he hoped to write titled: "The Genuine Treatment of Metals." It was an advertisement to give to potential subscribers for a nineteen-part book on metals. Four parts were eventually written, but they were never published.

Although Swedenborg had envisioned that his trip would take him as far south as Italy, it was cut short because his father, Bishop Swedberg, urgently requested that he return home to Sweden. The Bishop wanted his

oldest living son to take charge of family matters regarding a growing dispute about the distribution of a substantial inheritance.[13]

He arrived in Sweden in early July and travelled immediately to the celebrated Swedish spa Medevi, located on the northeastern shore of Lake Vetter. There he met his sister Anna and her husband Eric. Not long after Swedenborg's arrival, his father and Christiana Arrhusia (1661–1739), the Bishop's third wife, came to Medevi to participate in the festivities surrounding the name day of Fredrik I, as well as to visit with his oldest son, daughter, and son-in-law.[14] Swedenborg had his four page *Prospectus* in hand, in case he might find interested subscribers.

Swedenborg took advantage of the King's presence in Medevi to write to him about a method to improve the processing of copper. The letter was dated July 14th. On the King's name day—perhaps to garner the King's attention concerning his letter concerning smelting copper—Swedenborg also presented him with a short ode titled "Festive Joy" (Acton 1948, 266). Whether prompted by the poem or not, the King forwarded Swedenborg's letter to the Board of Mines.

Swedenborg's letter was discussed by the board on October 4, 1722. The College was sufficiently impressed with his suggestion that they wanted to forward it to the mining authorities at the Great Copper Mine in Falun to test the process. Swedenborg believed that the process would increase the yield of copper by 10%, from ten to eleven *skeppund*. Before they sent the outlines of the experiment to the *Bergsrätt* in Falun, however, they asked Swedenborg for input regarding the instructions to be sent to Falun. To honor their request, Swedenborg wrote a memorial to the board

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[13] This dispute concerned the property of Captain Albrecht de Behm, Swedenborg's mother's brother. He had died when the Svedberg children were all quite young and the property had been managed by his mother's older sister Brita Behm (1670–1755). A partial distribution had been made that some of the children of Albrecht's five sister determined was illegal and they were planning to sue Brita. Bishop Svedberg wanted the matter settled out of court. Nonetheless, the matter did come to court before Emanuel's arrival in Sweden. On June 20th the court ordered that the property be distributed with the proviso that Brita Behm not suffer any financial loss (Acton 1948, 262).

[14] In Sweden every name has a day on the calendar associated with a saint. Fredrik's name day was July 18th. The King was in Medevi not only to celebrate the festivities publicly, but he was also on an *Ericsdagen* or progress through the kingdom to gain support from the people.

regarding the smelting of copper dated October 11, 1722. The report from Falun was received by the college on November 22nd. Despite the fact that Swedenborg promised a substantial increase in the yield of copper with the new method, the sentiment in Falun was traditional and unenthusiastic. The officials there reported that all recent tests to change methods or procedures were unsuccessful. Thus, it was reported that "this place has acquired a distaste for, and objection to, all those now called new fangled miners" (Tafel 1875, vol. 1, 415). Nonetheless, the officials indicated a willingness to do the trial. The report was turned over to Swedenborg and he wrote a reply, not to Falun, but to the President of the College of Mines, Gustaf Bonde, on December 7th. This seems to be where the matter rested. A trial never seems to have been made. However, the response may have made a positive impression on Bonde. Swedenborg later published the method in his 1734 volume on copper and brass that was part of his three volume *Philosophical and Metallurgical Works,* Dresden and Leipzig, 1734.

It is probable that Swedenborg's trip to Europe had the desired effect on the members of the Board of Mines with regard to Swedenborg. It gave him the needed experience and had sharpened his competence to serve as ordinary assessor. And the membership of the board had changed considerably since his 1720 application.

During the same time-frame, Swedenborg's brother-in-law Lars Benzelstjerna (1680-1775), who had been a bergmästare since 1713, was appointed an ordinary assessor in March of 1722 to replace the retiring David Leijell (1660–1727). Svante Linqvist reports that during the period of 1715–1725 the qualities of the personnel on the board changed. Half of the men who served on the College of Mines, at this time, came from other governmental departments, while the other half were trained in the apprentice system developed by the board. As the century progressed, more and more came from the well-developed apprentice system and far fewer came from outside of this system. He suggests that Emanuel Swedenborg career was an exception to both of these models.

With all this in mind, it is not surprising that Swedenborg continued to press his case to be unambiguously seated on the board. He wrote another petition to the College of Mines on February 12, 1723, and then again on March 20th asking for the college to address his right to sit and to vote. On April 1st the board agreed to hear his petition, and they invited

him to attend so that he might speak directly to them. At that point what they wanted to ascertain from Swedenborg was whether he would be willing to give precedence to men who were seated on the board after his extra-ordinary appointment had been made and he had, in fact, been seated. The two men were Assessors Bergenstjerna and Bromell. He was asked to acknowledge their seniority, and he agreed to this.

According to the board, this left one matter still unresolved, namely, would he come to agreement with his brother-in-law Lars Benzelstjerna regarding the question of seniority.[15] Swedenborg was asked by the board to talk to his brother-in-law. This concluded the April 1st board discussion concerning Swedenborg's seat. He attended the board meeting on April 3rd. He returned again on the 11th after a conversation with his brother-in-law Lars. He waited outside the main chamber until he was called in to continue the discussion of April 1st. He said he was willing to give Lars seniority, because he had been appointed as an ordinary assessor and was therefore obliged to attend all the sessions, whereas Swedenborg said that his extra-ordinary appointment gave him the right to attend sessions or not as he choose. He liked having such freedom and discretion. However, he did stipulate that his extra-ordinary status should not be held against him in the future, and that he was willing to take his place immediately below Lars Benzelstjerna. With this agreement, Swedenborg finally took his seat on the Royal College of Mines. A little over a year later, when Magus Bromell was named the chief physician, Swedenborg was at last awarded a position as an ordinary assessor with a salary. His brother-in-law was named to Bromell's position and salary; and Swedenborg was awarded his brother-in-law's salary which had been at the level of a Bergmästare. The amount was 800 dalars in silver. Six years later in June of 1730, his salary was raised to 1200 dalars in silver, the amount due to an ordinary assessor in full standing. He was granted this salary when Asses-

[15] The issues between Swedenborg and Benzelstjerna was that Benzelstjerna had been first appointed an assessor in 1722, six years after Swedenborg had been appointed extra-ordinary assessor. He had come up through the ranks and has been an Auskultant and eventually was named a Mining Master in Falun. He went from that job to assessor. At the time his appointment was made, the board had passed over Emanuel in favor of Benzelstjerna. They took someone from inside the system, not the political appointee. Swedenborg had been slighted. The Board clearly did not want him to challenge this decision. Acknowledging Benzelstjerna would put the whole matter to rest.

sor Adam Liejel was elevated to the position of Councillor, upon the death of Anders Strömner (Tafel Vol. I1875, 440).

Unfortunately this was not the end of the challenges to Swedenborg's position at the College of Mines. In 1725, Anders Swab (1681–1731), Master of Mines at Falun, petitioned the King to recognize his assessor's warrant. It had been issued in 1716 concurrent with his post in Falun which he had assumed in 1714. During the ensuing years he remained in Falun, and he had never taken his seat on the board; but now wanted to have his appointment to the board officially recognized. What was at stake was not Swedenborg's seat nor those who preceded him on the board, namely Bergenstjerna (1720) and Benzelstjerna (1722), but precedence. Swedenborg wrote protests to the King, as did the other assessors; however, in June of 1726, the King decided the matter in support of Anders Swab. Thus, in 1730 shortly after the death of Councillor Jonas Cederstedt, Swab took his seat in November ahead of the active assessors he had superseded. He held the position only briefly. Upon his death in June of 1731, Bergenstjerna became Councillor. His brother-in-law Lars finally achieved that rank in 1744.

The Composition and Culture of The Board

During Swedenborg's tenure on the Royal College of Mines, he served with twenty-three other men. Over the thirty-year period, five men served as president for an average term of a little over six years. One president held the post for only two years, and another as long as eleven. The position of vice-president was eliminated in 1720. Seven men filled the two positions of councillor. Three of these men served relatively short terms: one for six months, another for three years, and the third for four years. The other four men held their positions between ten and sixteen years each. Fifteen men including Swedenborg held the position of assessor. Emanuel Swedenborg and Nils Porath both started as extra-ordinary assessors with the other thirteen men being appointed ordinary assessors. Swedenborg served as an extra-ordinary assessor for eight years and Porath for six. The average time as an assessor for these fifteen men was

8.9 years, with Benzelstjerna serving for twenty-two years and Swedenborg serving for twenty-three.[16]

All of the men who held the position as president did not come up through the ranks of the mining bureaucracy. Among other important positions all but one of them were at one time governors of Swedish provinces. While all the councillors had previously served as assessors, those who were named councillors after 1730 also had been *askultants.* Five men were assessors in 1716 (including Swedenborg) and ten were named after that date, during Swedenborg's tenure on the board. Thirteen of the fifteen men began their careers as *askultants*. The average number of years for those thirteen men to serve in the College of Mines' bureaucratic structure before they became assessors was almost twenty-one years. Magus Bromell and Emanuel Swedenborg are the only exceptions. Bromell was a physician and an associate of Urban Hjärne, and he only served on the board for two years. Swedenborg was appointed as an extra-ordinary assessor and never served the board in any capacity other than as an assessor.

Svante Lindqvist makes some interesting observations about what he sees as the shift in the personnel serving at the College of Mines, during 1715–1725. First, he suggest that during the period one group of executives conformed more to the seventeenth century recruitment pattern—the presidents of the board, for example; and another group more closely resembled the pattern that was to become the norm in the eighteenth century; that is, the men who were *askultants* first and who then worked they way up the board ladder. The older pattern were men who were political appointees, while the newer pattern were career men. To a certain extent, Emanuel Swedenborg was both of these. He was a political appointee, who was not an apprentice, but schooled himself and then became a career man. Lindqvist also makes it clear that there were no educational differences between these two groups of individuals; in addition the men in the first group were more likely to have been born nobles, while those in the second were more likely to have been untitled at birth, although, at least

[16] This average includes some individuals who served as many as fourteen to sixteen years, and others who served only three or four years.

through 1750, they were ennobled at some point just prior to or soon after becoming an assessor. (Lindqvist 1984, 102).

It should also be pointed out that not only was the board a tightly knit group of elite members of Swedish society, but as well, kinship bonds clearly played a role. During Swedenborg's tenure on the board, the two Leijel brothers, Adam and Daniel, were both assessors. Urban Hjärne's son-in-law, Daniel Tilas (1712–1772), became an assessor in 1745, and both of his sons started their careers as *auskultants*. Eight members of the Bonde family are listed in Almqvist's biographies, including the very first President of the Royal College of Mines, Carl Bonde, Gustaf Bonde, and his son Gustaf Gabriel Bonde. Swedenborg also had many relatives on the board: Anders Svab (1681–1731), his step brother, and his brother Eliezer's wife's third husband; Lars Benzelstjerna (1680–1775), his brother-in-law; Johan Bergenstjerna (1668–1748), his brother Eliezer's wife's fourth husband.[17] In addition, Erik Benzelius' son Erik (1705–1767)—Swedenborg's nephew—was an assessor, as were the sons of Lars Benzelstjerna, who were also nephews. Altogether five Benzelstjernas are listed by Almqvist. Thus, one can say that the members of the Royal College were closely connected by status, education, training, family, and marriage.

In order to contextualize Swedenborg's career on the Board of Mines, it would be useful to present short biographies of three men who served with Swedenborg as described by Almqvist in his *Bergskollegium och Bergslagsstaterna 1637–1857*: one president, one councillor, and one assessor.[18]

Count Gustaf Bonde was born in 1682, and was thus only six years older than Swedenborg. It appears that he was tutored at home, and then studied abroad at Tübingen in 1703. When he returned to Sweden, he became a councillor at the Commerce College in 1711, and in 1718 he became governor of Östergötland. He moved to the presidency of the College of Mines in 1721, and in 1727 he was named a Councillor of the

[17] Eliezer Swedenborg (1689–1716) was married to Elizabeth Brink(1684–1745), who was five years his senior. She was married to Georg Brandt, Eliezer Swedberg, Anders Svab, and Johan Bergenstjerna.

[18] The College of Mines and the Mining District Officials 1637–1857; translations from Almqvist's biographies of officials are by the author.

Realm. He became a member of the Academy of Sciences in 1748, and died in 1764 (Almqvist 1909, 175).

Adam Leijell was born in Stockholm in 1669, and became a student in Uppsala in 1679. He toured Europe between 1690 and 1695. Upon his return he was named *auskultant* in 1696, but appears to have been dismissed a few months later from the domestic Swedish mining administration. In 1699 he received a stipend as a scholar; and in 1700 he became the Mining Master in the eastern and western Bergslagen region of Sweden. He was named an assessor in 1713, was ennobled in 1717. The next year he became director of the Hällefors silver mine. He was named councillor at the College of Mines in 1730, and retired with the title of Governor in March of 1744, and died the same year in October (Almqvist 1909, 231).

Johan Angerstein was born at Turbo Foundry in Hedemora parish in 1672. His father was a miner. He was a student in Uppsala in 1683. He was an assistant to Mining Master Odhelius for two years before he became an *auskultant* in 1695. He received a stipend while he studied chemistry in 1700. He took a foreign tour between 1700 and 1705. He was appointed prosecuting counsel in 1705, and was named an assessor in the College of Mines in 1708, where he remained until his death in 1720 (Almqvist 1909, 164).

It is interesting to note that Almqvist's biography of Emanuel Swedenborg is quite minimal. He writes that Swedberg was born in 1688, but does not indicate where. He also does not mention that he was a student in Uppsala (1699–1709), nor that he took a foreign tour (1710–1715). He indicates that he was named an extra ordinary assessor in 1716, and that he was ennoble in 1719. He also neglects to mention his second foreign tour, specifically of mines in 1721 through 1722. He indicates that he became an ordinary assessor in 1724 and a member of the Royal Academy of Sciences in 1741 and was retired with a pension of half his salary in 1747. He adds that he was a "world famous religious founder and a renown scientist;" he died in London in 1772 (Almqvist 1909, 285).

Clearly Swedenborg's path to an assesssorship was different than many of his fellow assessors; however, his education and early training do resemble theirs. Although he was highly recommended by Christopher Polhem (named assessor in 1714 and ennobled 12/15/16), there was some

resistance by one Baron S. Cronhjelm (1666–1724) to his appointment when it was made. His warrant had to be rewritten making it clear that Swedenborg could become an ordinary assessor, should a seat become vacant. This new warrant had to be written by Cronhjelm himself in the presence of the King and Swedenborg, as well as the letter announcing his appointment to the Royal College of Mines (Acton 1948, 127).

As we have seen, there was obvious resistance to Swedenborg on the board also. The board was a small, influential, group of men, who guarded their privileges and their experiential acumen. When Swedenborg began to press his case, in 1719, he had only recently been ennobled, was a young unknown. There was no compelling reason to take his petitions too seriously. Even though Assessor Christopher Polhem (1661–1751), the mechanical genius, had recommended Swedenborg, he was busy with his own affairs in Falun and had little contact with and influence on the board. However, by 1723, he was acknowledged as a scientist with a solid international reputation and a man who had valuable contacts abroad among the learned and within mining circles. That in three short years, Swedenborg was able to overcome their resistance speaks to his persistence, and willingness to gain the necessary experience and to demonstrate his genuine competence sufficiently to merit real consideration. It also speaks well of a board that was willing to recognize his talents as an observer and scientist. Almost immediately after he was seated, they turned to him as their most distinguished scientist to evaluate new mining technology and its potential adaptation to Swedish conditions.

Swedenborg's Career with the Royal College of Mines

A case study—Assessing a steam Engine

One of Swedenborg's first assignments on the Board of Mines involved his assessment of a "water engine" that might be productively adapted for use in Sweden's mining industry. On May 3, 1723, not long after Swedenborg took his seat on the board, he was present when the utility of such an engine was discussed. Swedenborg must have been interested in the presentation and discussion because he had a longstanding interest in new technology. Scientific instruments delighted him, particu-

larly if they were new and inventive. He had met Francis Hawksbee (1666–1713), the famous instrument-maker, in 1712 in London and had sent a copy of his book, *Physico mechanical experiments*, to Benzelius which contained a drawing of an "Antilian" (air-pump) that in principle bears resemblance to the "water engine" (Acton 1948, 41). He had also given a copy of Kalmeter's first report on the Newcomen engines, found in Newcastle, to the Uppsala Scientific Society in 1720.

On his second European trip, when in Liege, given his interest in new technology, he may have seen John O'Kelly's Newcomen engine, constructed in that city earlier in the year. If he did not see it, he certainly must have heard talk about it. Swedenborg's interest in technology was not for its own sake, for he had a real passion for the economic development of Sweden, as can be seen by his many memorials sent to both the *BergsKolligium* and the House of Nobles. His proposal to increase the yield of copper is just one example of this.[19]

In February of 1725, Swedenborg demonstrated his knowledge and interest in technology when he suggested in a memorial on the 14th that the Bergskolligium purchase an air-pump. He justified his suggestion by indicating its experimental utility: "by such an antlia pneumatica can be exhibited hundreds of experiments which concern air, fire and water, and one would gain experience in much that pertains to physics" (Acton 1948, 367). When the memorial was read in session, it was discovered that not a single air-pump was to be found in Sweden.

It should be noted that on the same day, Swedenborg had presented another memorial to the board regarding the deplorable state of the mechanical laboratory and the machines its contained and his desire to see them repaired and restored. In the memorial he mentions that he has two *askultants* who could assist in that work—Daniel Bergenstjerna (1706–1773), son of Assessor Bergenstjerna, and J. J. Faggot (1892–1777) . Both of Swedenborg's requests were granted. He was to oversee the restoration of the machines in the mechanical laboratory, using the funds for the laboratory for that purpose. In addition, Swedenborg was to use laboratory

[19] Some of Swedenborg's early memorials are: "On the Balance of Trade"; "in Favor of Iron"; "Against the Exclusion of Foreign Traders"; "On Manufacture of Steel"; "On Farming Out Customs."

funds for the purchase of the air-pump from the Hawksbee's in London, at a cost of 1000 dalars k. mt.[20]

It is evident that by now Swedenborg had a solid reputation among the members of the board because these matters were not only fully discussed and supported, but were also resolved within days, and Swedenborg was assigned to oversee them. The air-pump arrived from England later in the spring. Swedenborg was indignant to learn that the Customs House wanted to charge a duty (300 dalar k. mt) for the importation of the pump—a machine that was for the public use. He sent a memorial to the board on May 27th requesting that a deposit be made on the duty, while relief from the duty is sought from the King and/or the College of Commerce. He felt that a deposit would allow the boxes containing the air-pump to be removed immediately, rescuing them from any harm (Acton 1948, 373). It is presumed that the air-pump was quickly released, because there are no further exchanges on this matter.

Lindqvist highlights Swedenborg's and the board's focus on "public use." He writes: "In this argument about the duty on Hauksbee's air-pump in 1725 we hear an example of a justification for science that was to echo throughout the eighteenth century: the public utility of science" (Lindqvist 1984, 163). What is interesting to note here with regard to Swedenborg is that he was immersed in a culture of "use" and that in his religious works he elevates this concept to be the central focus of human spiritual life.[21] It is my contention that his intimate relationship with a focus on use during his career on the Board of Mines was a central component of his preparation to become a revelator and become the "eyewitness to the Apocalypse."

On a more immediate level, however, Swedenborg's interest in and knowledge of such advance technological machinery as the air-pump and the Newcomen engine was now fully apparent to the board. Thus, when the board was asked in April of 1725 to make an assessment of John

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[20] dalars k. mt. refers to Swedish copper currency. It should also be noted that the Hawksbee enterprise was now in the hands of Francis the younger (1687–1673) who was a noted English scientist and a member of the Royal Academy.

[21] A central teaching of Swedenborg's theology is that use is produced from the conjunction of love and wisdom; or that it is the fruit of good loves formed by truth.

O'Kelly's proposal to build a Newcomen engine in Sweden, Swedenborg was the man chosen to do so. As the board's most competent scientist, he was asked to give his opinion of the new engine.

In order to do so, he was give letters from his friend, Joakim Fredrik Preiss, who had been asked by the government to research the engine in Liege. Preiss had written detailed letters about it, and in addition he had checked on O'Kelly's claims that he had received a commission to build an engine in Biscay. He had even asked a Swedish engineer, Anders Fischer, to evaluate the engine and to make a drawing of it when he went to Liege. Swedenborg also given the copy of O'Kelly's drawing of the engine that the board had received on April 28th. Along with the drawing was a discussion of the operating principles of the engine written by O'Kelly in French (Lindqvist 1984, 163).

Swedenborg presented his report on May 5th—five pages of text with a drawing. It was a comprehensive report listing both the pluses and minuses of such an engine, in an attempt to give a balanced assessment of it, not make a judgment about the desirability of the new technology. With his drawing he also illustrated a method to calculate the diameter of the cylinder because O'Kelly had done this incorrectly.

Lindqvist has created an abbreviated list that I will include here:

Disadvantages

1. It could not easily be adapted to the geographical environment in Sweden (lack of coal)
2. It demanded a new type of engineer with scientific training
3. It was difficult to determine the technical limitations of the new technology because there was no experience of building machines driven by steam and made of iron
4. The auxiliary technologies (available in Sweden) put a limit on the utility of the engine
5. The technologies already available were generally sufficient.[22]

[22] The sufficiency of the existing technology suggested no need for this new type of technology. Thus, their sufficiency disadvantaged the proposed engine.

Advantages

1. More power than from any traditional technology
2. Useful where there was no running water and an abundance of wood fuel
3. A fascinating new technology (Lindqvist 1984, 167–168).[23]

After setting forth the disadvantages and the advantages of the new machine, Swedenborg wrote about O'Kelly's method of calculating the diameter "by the simple rule of three":

> But this rule ought to be changed to the extent that instead of the diameter of the cylinder the area or quadratum diametri should be used, since the pressure of the atmosphere on circular bodies [. . .] is not proportional to the diameter of the cylinder but to its area (Lindqvist 1984, 168).

The board heard Swedenborg's report on the 5th, and on the 14th worked in both the morning and afternoon sessions to draft the letter to the government. The final draft was read on May 15th before being signed by the members of the board, including Emanuel Swedenborg. Lindqvist writes: "The letter followed Swedenborg's memorandum word-for-word for the most part but those changes that were made illuminate the opinion of the new technology held by the board as an institution" (Lindqvist 1984, 170).

One thing the letter does is to change the positions of the advantages and the disadvantages, putting the advantages first. Perhaps this indicates a more positive attitude toward the new machine by other members of the board than Swedenborg. They also said that the amount of water that could be pumped daily was 600 barrels, not 500 as Swedenborg had written. This was based on information about the Newcomen engine that they had from a 1720 report about the engine in Newcastle. They also included Swedenborg critique of O'Kelly's method of calculating the power

[23] What Swedenborg wrote with regard to number 3 was: "Furthermore it is of an extraordinary interest, in that a new principle, viz. fire, evaporatio aqua and vacuum operates the whole movement, which is otherwise done by moventia mechanica" (Lindqvist 1984, 167).

of the engine by using the diameter instead of using the area. However, they did not include Swedenborg's diagram, and wrote that the geometrical method of calculation can be demonstrated "with drawn lines" (Lindqvist 1984, 170). They ended by saying that the report lay before his majesty both the advantages and promise of the new engine, but also its inherent difficulties.

Linqvist in his book is dealing with the application of steam technology to removing water from a silver mine in Dannemora that had to be closed due to serious flooding. Shortly after the Royal Academy of Mines issued its report, Mårten Triwald (1691–1747) was granted permission by the government to build a "fire and air" engine to pump the water out of the silver mine and restore it to use. The machine was built in 1728, but it never functioned properly. Eventually the investors brought Triwald to trial. Nevertheless, Triwald is best known today for his role in founding the Royal Academy of Sciences in 1739. Swedenborg became a member in 1741.

Given this context it is useful to reflect on Linqvist's comments on the board's assessment of the technology:

> As an assessment of the new technology, the reply of the Board of Mines was admirably comprehensive, considering the information available. As will be shown later, the case of the Dannemora engine was to prove it right on every point, and we must give credit to Emanuel Swedenborg for having carried out the first technology assessment of the steam engine in Sweden (Lindqvist 1984, 170).

Lindqvist also credits Swedenborg for his keen appreciation of the link between theory and practice. As he writes:

> This controversy over theoretical knowledge had not been lost on Emanuel Swedenborg. He refers to the need for awareness of the theory in his technical assessment, and it was subsequently repeated by the Board of Mines in its reply to the Government. Swedenborg wrote that the design of the engine was 'based not only on the laws of mechanics, but also on those of physics.' To maintain such an engine in operation would there-

> fore require the supervision of a man 'who understands the mechanical and also the physical laws' (Lindqvist 1984, 177).

Although Lindqvist goes on to suggest that linking theory and practice in the early part of the eighteen century was used as a power play to gain the upper hand in competition, his analysis of some of the mistakes Triwald made in the construction of his "fire and air" machine were precisely because he did not take theory into account. He increased the size of the cylinder without altering the proportions of any other parts of the machine.

In this case study of one of Swedenborg's assignments on the Board of Mines, he is shown to have played an extremely important role in the assessment of new technology. He could play that role because he was well versed in science as well as having practical experience with mining technology due to his close relationship with Christopher Polhem, and the extremely practical experience of being a mine owner himself. While Lindqvist incorrectly states that he was the major shareholder at the Axmar Ironworks in Gästrikland, it is true that at the same time he was involved with assessing the steam engine he was fully committed to his role as a partial owner of the ironworks. He understood all of the practical aspects of iron production.

Lindqvist also points out that the Board of Mines' role was primarily advisory, particularly with regard to the importation and development of new technology. Its role was to oversee and maintain all on-going mining activities and those of corollary groups including those who produced charcoal, smelted iron and copper, and handled the exporting of bar iron and copper. With regard to innovation and development, they had only an advisory role, leaving these other initiatives to private individuals and groups.

Broader Outlines of Service

This case study also gives a good introduction to some of the issues that were of importance to the board and that involved Swedenborg's energies during his years of service on the board. Swedenborg served on it

for thirty years. During that time he was absent for eight full years. Three of those years were before he was seated as an ordinary assessor in 1724, and five of those years involved leaves of absence to go abroad to publish and do research. This leaves twenty-two years of service when he was regularly involved. It appears that when the board was in session it met six days a week. It certainly would never meet on Sundays, and other religious holidays such as Good Friday, Easter, and Christmas. Minimally, if we add these two holidays to the number of Sundays in a year, there would be fifty-five days out of the year that the board would not meet, leaving a possible 310 days for sessions. No doubt other days were holidays as well, and from time to time the board took a recess during the summer. Swedenborg also took extended tours in the mining districts of Sweden, lasting from several weeks to two months. From 1723–1735 he took sixteen such tours, with the greatest number or six tours taking place in 1725 and 1726. After 1735, he only took two such tours.

It is also true that Swedenborg and some other assessor would be also assigned to inspect and test the quality of iron at the iron square in Stockholm. Or they might be asked to join a deputation of the chancery. When the House of Nobles was in session the members of the board frequently were absent to attend to matters connected with the riksdag. Swedenborg and Lars Benzelstjerna also took a month-long leave to attend the funeral of Bishop Svedberg.

Over these twenty-two years, it is also possible to notice changing patterns of attendance through out the year, with very high attendance in March, often attending on twenty-seven out of thirty-one days, and again in November, often attending twenty-six out of thirty possible days. Summer, in general had lower days of attendance and often inspection tours took place then or in the September-October timeframe.

During Swedenborg's first two years on the board he attended a total of 146 sessions. During the next two years, despite the fact that he was often away on inspection tours, he attended 308 sessions. From 1727 until he went abroad in 1733, he averaged 221 sessions a year, with the second highest number of sessions he ever attended occurring in 1732, at 282. The highest number of sessions Swedenborg ever attended, 288, took place in 1741, just after he had returned from an extended stay abroad, traveling as far south as Rome.

Swedenborg attended 247 sessions the next year, and 114 before he left for another trip to publish the *The Soul's Domain*. It is during this trip that he had the profound spiritual experiences in the form of dreams that altered the direction of his life.

Feeling called by the Lord to serve Him in what ever capacity he required, when Swedenborg returned to Sweden in August of 1745, his attendance patterns at the board significantly altered. While he attended a usual number of days in September (twenty-six) and a bit less in October (nineteen), he only attended nine days in November and two in December. He attended a total of sixty-two session in 1746, two in January, a high of fourteen in March, zero in August, three in November and eight in December. In the remaining months of that year, he attended perhaps nine or ten days per month. The number of sessions increased in 1747 to ninety from January through July when he retired. He attended thirteen in January and a high of twenty-four in March. It should be pointed out that he served as president for some sessions in 1746 and more in 1747. Just prior to his June resignation he was named to the position of Chancilor, an honor and responsibility that he declined. He attended his last full session of July 1, 1747 and took leave of the board on July 17th, before sailing to Holland on July 24th.

It is very interesting to note the change in his pattern of attendance because the amount of unpublished writing he was doing on his biblical studies and spiritual experiences filled over 4,000 pages. Now while it is true that some of these pages were concordances to various parts of the Bible, it is still an astounding output; it is a wonder that he was able to attend any sessions at all. And during this time it is noted in the minutes of the Bergskolligum that he continued to participate in the work of the board.

Broader Outline of Duties

It has already been noted that the board had executive, legislative, and judicial duties. In order to fulfill these responsibilities, there were administrative functions related to the management of the staff in Stockholm and coordinating roles with the staff in the outlying mining districts. There were also fact-finding inspection tours, duties related to developing legis-

lative policies, then presentation of those policies in the various districts to the various constituencies, and judicial functions. With regard to all these different duties, during the course of Swedenborg's career on the Board of Mines his name is mentioned in the minutes in relations to 334 separate items of business.[24] These items of business fall into three broad categories: administration, inspections, and judicial cases.

Forty-eight percent of the deliberations and decisions involved administrative matters concerning personnel, procedures, or mining activity; thirteen percent concerned reports to the board from board members commissioned to inspect mines; and thirty-nine percent disputes between two or more parties involved with mining or an individual who was accused of violation some mining law or statute.

Administrative matters concerned such things as Swedenborg's memorials, discussions of his seat, questions of pay and seniority, applications for various mining privileges (such as for manufacturing steel), discovering new mines, building new blast furnaces, deciding to buy the air-pump, repair the machines in the mechanical laboratory, or evaluating the Newcomen engine.

Inspection tours focused on such matters as combining the foundries and reducing the forges in the Farnbo district of Värmland, the inspection of a grinding machine, the inspection of mining practices at the Great Stora Kopperberg Mine in Falun, inspecting land belonging to Carl Gyllenborg related to petition to the board, investigation of the Sala Silverworks, and the inspection of a site of hard coal discovered in Västergötland, among others.

The cases ranged from Swedenborg's own with Brita Behm, to the one between miners in Ramshyttan and the heirs of Schnack; the case of the

[24] This number comes from a list generated from a typescript of Board Minutes related to Swedenborg complied by Cyriel Odhner Sigstedt in 1925. The typescript is 720 pages long and is housed in the Archives of the Swedenborg Library of Bryn Athyn College. Unfortunately, only Swedenborg's comments are included; and although the author attempted to provide some context, it is insufficient in most cases in order to evaluate Swedenborg's contributions to the events at hand. That is why the Lindqvist discussion of Swedenborg's contribution is so valuable to understanding his work on the board. While no doubt Ms. Sigstedt was thorough and probably found all the references to Swedenborg, going through this material again could possibly lead to finding additional references. However, even if more references are not found, In order to really see Swedenborg's contribution, it will be necessary to go through the Minutes once more to review a selection of entire cases in order to contextualize the material already collected.

shareholders in Elfkarleby and the deceased Councilor of Mines David Lejell; the case of Madame Broms and Bookkeeper Edström; the Case of the Robsahm heirs concerning tithes; the case of the Fiscal Advocate against Chancery Clerk Duseen; that of Peter Swedberg; that of Count Gyllenborg's complaint again Surveyor Ehrenström; the heirs of Schonström's complaint again Carl Broman, and the case of keeping goats at Andrarums AlunBraks District.

Two cases will be chosen to illustrate the work of the board in general and Swedenborg's perspective in particular. In looking at these cases and reflecting on the many others that he was called to participate in through his work on the Board of Mines, it is possible to see that Swedenborg's profession in this world was in connection with law and justice.

The first is the Duseen case. Swedenborg was the referent for the case, meaning that it was his responsibility to present the case to the court. It came before the court on May 15, 1741. The fiscal advocate demanded that Canslisten Duseen be incarcerated because he had made threats on the life of Assessor Nils Porath. Swedenborg advised that the court proceed with caution because without care, the court might make Duseen's condition deteriorate. While the majority was willing to condemn Duseen for this one infraction, Swedenborg seems to have taken pity on Duseen's weakmindedness and intoxication. He asked the court to find "whether Duseen's weakmindedness is caused by this intoxication, or his intoxication by his weakmindedness." Today perhaps an expert witness would be called in to assess Duseen's mental condition, to see if he was capable of understanding his own actions, and to understand the legal process. Odhner notes that at the time Swedenborg had to present this case, he was studying the diseases of the fibre (Odhner 1927, 3).

The other case is that of the keeping of goats in the Andraums AlunBraks district. The goats had come to the attention of the board because they were running in the forest and doing great damage to the trees there. Trees were an essential part of the mining business, particularly in the creation of charcoal. It should be noted that at this time, officials in Sweden were of the opinion that their forests were shrinking and not being reforested. Soon after this case came before the court, this misperception would lead to the capping of iron production at current levels, and allowing the Russians to take a much larger share of the

European import market, particularly in Great Britain. So one can imagine the concern of this particular herd of goats. While all the assessors hearing this case agreed that goats are very damaging to forests, especially to the fruit- bearing trees, and also can cause the tree growth to be stunted, in the unfolding of the case, it turned out that the goats were currently being herded by the peasants because the cattle in the region had been devastated by disease.

The peasants in their petition were seeking to be permitted to keep the goats until the next riksdag, as a form of restitution for the loss of their cattle. Swedenborg, in his opinion, agreed with the peasants petition that they ought be be permitted to keep the goats with goatherds on their farms until the next riksdag, since without them, they and their children could fall into grievous destitution and hardship and possibly suffer famine.

Conclusion

In both of these cases in would appear that Swedenborg took the human condtion into account. Thus, he moved beyond the hard fact of the cases and expressed concern and compassion. It is possible to imagine Swedenborg attending sessions at the Board of Mines on a daily basis, day after day, year after year, walking first from his apartment on Gamla Stan and then later in the 1740s from his home on Hornsgatan on Södermalm through rain and snow, days of sunshine and days with overcast skies to participate in the multi-varied work of the Royal College of Mines. At the board he dealt with countless administrative details, technological breakthroughs, struggles over inheritances, and vexing disputes between individuals and officials. It would appear that while some individuals could be worn down and become cynics in such a role, Swedenborg was able to respond with both head and heart. In an environment focused on use and the public good, Swedenborg internalized a living love of use that opened him to humbly accept the call to serve the Lord. In fact, it is possible that it was his service on the board that was the incubator of his call rather than all his intellectual striving after first things. However, once called, they, too could serve. ❑

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