



Open access to metallurgical publications

by R.T. Jones*

Synopsis

Technical publications in the field of mining and metallurgy have existed for a long time. Recent developments in electronic publishing on websites make it possible to disseminate information more widely and cost-effectively than before. Professional societies have an opportunity to serve their members and their industry by publishing high-quality peer-reviewed papers on their websites as well as in printed form. Older publications can be scanned, and optical character recognition used to provide searchable text. Various business models exist around this process. This paper outlines the approach used by the Southern African Institute of Mining and Metallurgy (SAIMM) to provide free open access to their journal papers and conference proceedings, as well as the work being done by OneMine.org to collect technical papers from a number of international societies and make them available to subscribers via a large database. An approach is outlined that should be of benefit to authors, readers, and society at large.

Keywords

open access, publishing, metallurgy, SAIMM, Mintek, OneMine, Infacon, pyrometallurgy, peer review, self-archiving.

Introduction

Georgius Agricola (1494-1555) was not the first writer on the subjects of mining and metallurgy, but is well known as the author of *De Re Metallica* ('of things metallic' or 'on the nature of metals'), a book that documents and illustrates the observations he made in the course of his extensive travels in the 1500s. Agricola wrote extensively about mining methods and metallurgical processes that were in place in the Middle Ages. The original Latin version of *De Re Metallica* was published in 1556, the year after Agricola died. It was translated into English by Herbert Hoover, a mining engineer and later president of the United States, and his wife Lou Henry Hoover, a geologist and classicist. The English version of *De Re Metallica* was published in 1912.

In his preface to *De Re Metallica* (Agricola, 1556), the author says:

'I have omitted all those things which I have not myself seen, or have not read or heard of from persons upon whom I can rely. That which I have neither seen, nor carefully considered after reading or hearing of, I have not written about.'

Although *De Re Metallica* is probably the best known medieval book on mining and metallurgy, the first printed book on metallurgy to have been published in Europe is considered to be *De la Pirotechnia*, written in Italian by Vannoccio Biringuccio and published in Venice in 1540. This book (Biringuccio, 1540) gives details on mining practice, the extraction and refining of numerous metals, and the production of alloys such as brass.

Perhaps these first two books on metallurgy could be considered to be the start of the tradition of scientific and technical literature in this field.

Scientific publishing of journal papers has been in existence for about 350 years. The world's oldest and longest-running scientific journal, the *Philosophical Transactions of the Royal Society*, was first published in March 1665, in London. 'Henry Oldenburg – Secretary of the Royal Society and first Editor of the publication – ensured that it was "licensed by the council of the society, being first reviewed by some of the members of the same", thus making it the first ever peer-reviewed journal.' (Royal Society, 2011)

The nature of scientific societies has changed since the early days when regular meetings were held to discuss science and run experiments. The reading of scientific papers took place, and papers were published to record the proceedings of meetings. Learned societies nowadays exist to promote an academic discipline or profession, and are mostly non-profit organizations. They typically hold conferences for the presentation and

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Figure 1—Georgius Agricola and one of the woodcut illustrations of a smelter in *De Re Metallica*

discussion of new research results, and publish or sponsor academic journals in their discipline. The system of peer review (significantly flawed, but the best we have) is used to maintain standards and to improve the quality of papers, but reviewers need to be chosen carefully and monitored. Nowadays, some learned societies continue to publish journals themselves, while others have contracted this job to commercial publishing companies.

In recent times, the Internet has transformed the dissemination of knowledge, a capacity once exclusive to publishers. This raises the questions of access and funding. Some journals, especially those operated by commercial publishers, charge for access to the papers published in their journals. It is also the case that some journals adopt an author-pays funding model, sometimes with concessions being made for free publication by those who cannot afford to pay (maybe because of no institutional support) so that no-one is prevented from publishing because of financial reasons. The so-called *open-access* approach is discussed in greater detail in the next section of this paper.

In the interests of making scientific information available to a wider audience, the Royal Society announced in October 2011 that they had made the historical archives of the *Philosophical Transactions* (over 60 000 scientific papers) permanently free to online access from anywhere in the world. All of the historical archival papers (published more than 70 years ago) from the *Philosophical Transactions* are now freely available on their website. Current publications are available via *delayed open access* where older articles (12 months for biological sciences, and 24 months for physical sciences) are made freely available. They also allow a *hybrid open access* or open choice option where authors can pay an article-processing charge that allows for their article to be made freely available immediately upon publication. Such articles are covered by a Creative Commons licence allowing redistribution and re-use. (Royal Society, 2012)

Open access

In academic publishing, authors are not paid by the journal for their writing; peer reviewers give their time voluntarily to

evaluate papers and suggest improvements; and journal editorial boards (and, sometimes, even journal editors) are unpaid. However, scientific papers can be very costly for readers to obtain (typically tens of dollars per paper). Perhaps this could be justified in the days before online publishing, as much cost was incurred in the mechanical reproduction and dissemination of the information to a rather niche audience. However, it kept academic work largely inaccessible to the general public. Nowadays, low-cost publishing on websites has changed the cost structure of information publication and dissemination, making it possible to extend the reach of information to a much greater worldwide audience. Online publishing also allows articles to become available sooner than printed versions. There is considerable support for the idea of a more open research literature.

It is interesting to note that the principle of copyright was set up to limit the free exchange of published information in exchange for providing an economic incentive to the author, so that we may all enjoy more works. In the case of academic publishing of technical papers, it seems that this principle is somewhat inapplicable, as authors are generally rewarded only by the scholarly impact and increased citation of their work and do not gain financially from the sale of their papers. Perhaps the copyright restrictions should be amended to stay with the author (and not be used to withhold access from the public) and only a licence should be given to the publisher to enable them to reproduce the work and to coordinate the giving of permission to others for further reproduction. [There is an important distinction to be drawn between work that scholars want to give away (journal articles, conference papers) and work from which they expect to derive income (books), and this present discussion focuses only on the former.]

Open-access publishing is an initiative that aims to provide universal, unrestricted free access to full-text scholarly materials via the Internet. This presents a radically different approach to the dissemination of research articles that has traditionally been controlled by the publishing enterprise that regulates access by means of subscriptions and licences fees levied on users, predominantly academic libraries.

Open-access publishing is based on the principle of maximizing the ease with which publications can be obtained. Open publications are visible to search engines, such as Google, thereby making them easily found. This serves the interests of authors, in that they want their writing to have maximum reach and impact, and want their work to be discussed and cited often. It also serves the interests of readers who desire low-cost or free access to a wide range of information. Peer reviewers are usually also authors and readers, so their interests are looked after too. However, it is also very important to safeguard the interests of publishers or scientific societies, as these bodies have high reputations and ensure the trustworthiness of what is published. This paper examines the models or approaches that have been used in a number of instances.

Sources of funding for scientific societies include membership fees, subscriptions to journals, sale of publications, sponsorship, limited advertising, conference fees, and article-processing charges.

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Through proper management of open-access publication, it is possible to maintain the same standards of high-quality production of peer-reviewed papers, with the potential for greatly increased dissemination and citation. Some research-funding bodies have encouraged open-access publication by removing the consideration of a journal's prestige or impact factor in their screening of grant applications. For example, the Wellcome Trust 'affirms the principle that it is the intrinsic merit of the work, and not the title of the journal in which an author's work is published, that should be considered in making funding decisions'. (Wellcome, 2012)

The high cost of obtaining published papers can be seen as a barrier for scientists and engineers working in the poorer countries of the developing world, as well as for unemployed scientists who would like to keep abreast of their fields while seeking work. Open access provides unrestricted availability to publications to anyone with a connection to the Internet. Möller (2006) has examined the case for open-access publishing of journals in a South African context.

Another benefit of having open access to scientific papers is that search engines can be used to find associations between items that would be missed by human readers of individual papers. 'Re-inventing the wheel' can sometimes be avoided by ensuring that older papers are readily available to researchers.

Today's world faces many policy choices on issues such as climate change, energy generation, and recycling. These issues cannot be properly addressed without widespread access (even by the general public) to the results of scientific research in each of these areas. The British government has recently announced an initiative to make all taxpayer-funded research available online to anyone who wants to read or use it (Jha, 2012b). It is hard to argue that keeping scientific information behind expensive pay walls is in the best interest of society. There is an increasing degree of dissatisfaction in the scientific community (Jha, 2012a) with the degree of control exerted by the 'big three' publishing houses (namely Elsevier, Springer, and Wiley) who own most of the world's more than 20 000 academic journals, and account for about 42% of all journal articles published (Jha, 2012a).

Commercial publishers are concerned about losing their revenue stream to open-access competition (Butler, 1999). There is some scepticism about the economic viability of the open-access model of publishing (Boshoff and du Plessis, 2011), but these objections are often easily overcome (Taylor, 2012). It has also been argued (Boseley, 2005) that there is a moral imperative to remove restrictions of access to the scientific literature. There is a fundamental question that needs to be addressed by learned societies – are they there to make a lot of money from publishing to underwrite their other activities, or are they there to advance science?

The SAIMM

The Southern African Institute of Mining and Metallurgy began life a few years after the discovery of gold in Johannesburg, when fourteen chemists and metallurgists met on 24 March 1894 at the North-Western Hotel at 21 Pritchard Street, Johannesburg, to form a society and elect a council. The society at that time was known as the Chemical and Metallurgical Society of South Africa. In 1903, it broadened its scope to become the Chemical, Metallurgical and Mining

Society of South Africa, and then in 1956 was renamed as the South African Institute of Mining and Metallurgy. The present name was adopted in 2006, to reflect the regional scope of the institute.

The SAIMM Journal is currently published monthly, and, of course, electronic copies of papers in PDF format are also produced. The SAIMM has printed copies of the Journal dating back to the inception of the society in 1894. Some years ago, a selection of the archival papers dating back to 1969 were scanned, and the resulting PDF documents were subjected to optical character recognition (OCR) so that the documents could be searched using the embedded OCR text, as well as read. These electronic documents were initially placed on the SAIMM website and made available at a cost. Members of the Institute were allowed free access to the online papers. About five years ago, the decision was made to make all of the papers available free of charge to everyone. This was in line with one of the main strategic objectives of the SAIMM, to disseminate scientific and technical information to the benefit of the mining and metallurgical industries, and was intended to provide the widest possible readership for authors who published papers in the SAIMM Journal. Opening up access (in searchable electronic form) to older historical information provided a rich source of information to readers who otherwise would have struggled to obtain it. The move to open-access publishing offered the additional advantage of simplifying the administration of the website.

There is an initiative currently underway to scan all of the remaining historical copies of the Journal (for the period 1894 to 1969). This has been supported by the Carnegie Foundation (as part of their effort to get a wide range of African journals online) and Sabinet.

SAIMM also makes its papers available to other online databases, in order to reach as wide an audience as possible. These include OneMine (discussed later) and the SciELO system that is managed by the Academy of Science of South Africa.

SAIMM sends out a monthly e-mail notification to members about the papers (with links to the actual content) to be published in the Journal.

The Institute also publishes proceedings of many mining and metallurgical conferences that it organizes. The cost of producing conference proceedings is covered by conference fees. Conference papers are made available online via open access a short period after the conference has taken place.

SAIMM is a not-for-profit society where much of the work is done by volunteers, supported by a small secretariat with paid full-time staff. Authors and peer reviewers give their time free of charge (or are paid by their employers to do the work), but other aspects of the publishing chain (such as editing, type-setting, proof-reading, printing, packaging, posting, and website management) clearly come at a cost. Advertising and sponsorship cover many of these costs, but the principal sources of income of the institute are membership subscriptions and conference fees.

It is in the best interests of authors to ensure that their papers are freely available to as wide an audience as possible. It is also in the best interests of readers to have free access to papers. For these reasons, SAIMM charges neither authors nor readers for papers published in their journal or conference proceedings.

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Mintek

Mintek is a state-owned national research organization, based in Randburg, South Africa, that works in the field of minerals technology. The Pyrometallurgy Division at Mintek started in about 1996 to make available all of its open publications (papers and patents) on its website (Mintek, 2012). In order to make the initial selection of older papers available, the question of existing copyright restrictions had to be addressed. In some cases, this was easily managed, by obtaining the permission of societies such as the SAIMM to make copies of the papers available on the Mintek website. In a few cases, where the copyright restrictions of commercial publishers were particularly onerous, pre-print versions of the papers were used instead of the as-published versions. There were also some papers (written by Mintek authors) where it was seen as expedient to go ahead with the website publication without being able to obtain explicit permission, on the understanding that these would be withdrawn if any objections were received. Suffice it to say that there have been no complaints at all in this regard. This repository of papers has now become a valuable resource to pyrometallurgists around the world, and these publications can easily be found via search engines. It also provides a very interesting snapshot of much of the work done by the organization. It is now a routine matter of policy for all published papers to be included in the pyrometallurgy section of the website. Some other technical divisions at Mintek have also recently started similar initiatives to put together online published compilations of their papers.

Many scholarly publishers, including Elsevier, Springer, and John Wiley & Sons, now include concessions in their copyright policies to allow some form of self-archiving of full-text articles by authors in their institutional repositories or on personal websites.

Infacon

Infacon (the International Ferro-Alloys Congress) was founded in South Africa in 1974 by the SAIMM, Mintek (then the National Institute for Metallurgy), and FAPA (the Ferro Alloys Producers' Association) when the first Infacon was held in Johannesburg. The intention of Infacon is to stimulate technical interchange on all aspects of ferro-alloy production. Infacon continues to contribute to the exchange of research and development information by publishing refereed papers covering the major and most of the minor ferro-alloys.

Infacon is controlled by the International Committee on Ferro Alloys (ICFA), whose objective is to promote the holding of the Congress every three years in appropriate locations and to maintain the established high technical standard. ICFA arranges the meetings of representatives from ferro-alloy producing and consuming countries during each Infacon to discuss the relevant technical content for Infacon and decide on the country that will host the subsequent Congress. The current members of ICFA include: ABRAFE (Brazil), CSM (China), IFPEO (Europe), IFAPA (India), JFA (Japan), TFA (North America), and FAPA (South Africa).

Permission was given at the 2010 meeting of ICFA to digitize all proceedings from past Infacon events and to make these (and future proceedings) freely available on a suitable website (Infacon, 2010). Proceedings from 2004 onwards

were already in digital format, but older publications had to be scanned and subjected to optical character recognition before the PDF documents could be made available online. This work-in-progress is intended to make all of the previous Infacon papers (from the 12 conferences held so far) freely available to all interested people.

It is hoped that future similar initiatives will take place to digitize and publish online the proceedings of other important series of conferences.

Pyrometallurgy in Southern Africa

In order to document southern African smelters, papers were solicited from as many as possible of the southern African pyrometallurgical plants, for presentation at the Southern African Pyrometallurgy conferences in 2006 and 2011. These papers include a description and some history of the operations, and some highlights of current work. These descriptions of plant operations are published as an online reference compilation that will provide very useful information for metallurgists entering the field. By publishing this information on a website (Jones, 2005), it can be updated as and when required. The compilation covers a wide spectrum of activities within the field of pyrometallurgy, also including some universities, research organizations, and engineering companies. The list of smelters covered is already quite extensive, and it is hoped to eventually achieve fully comprehensive coverage of all known plants.

The pyrometallurgy.co.za website also contains a list of international conferences (Jones, 2012) of interest to pyrometallurgists.

OneMine

OneMine was set up as a collaborative international venture between various technical societies that serve the mining and minerals community. Its objectives include the consolidation of knowledge into a centralized repository and the dissemination of this information to the industry, and the archiving and storage of older materials that are disintegrating due to age. Its database contains the full-text complete versions (in PDF format) of approximately 100 000 mining- and minerals-related documents. Some of these materials were previously available only in printed form. OneMine has gathered together technical documents, conference papers, and articles from numerous sources into a single comprehensive database and search engine. Titles are included in OneMine if they are known to maintain high standards for editorial integrity and credibility in the dissemination of mining and minerals research, and are well regarded by the scientific communities.

OneMine is an independent organization governed by a board of trustees. It was created in early 2007 by the Society for Mining, Metallurgy and Exploration (SME). Additional contributing societies, such as AIME (American Institute of Mining, Metallurgical, and Petroleum Engineers), IMMS (International Marine Minerals Society), and SAIMM (Southern African Institute of Mining and Metallurgy) adopted the concept quickly.

Since its launch in January 2008, OneMine.org has grown to the stage where, at the beginning of May 2012, it reached the milestone of having 100 000 mining- and minerals-

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related documents (comprising 1.6 million pages) on the site. There were approximately 140 000 downloads during 2011. The time span of the documents ranges from 1871 to the present day.

The current list of participating societies includes:

- AIME - American Institute of Mining, Metallurgical, and Petroleum Engineers
- AusIMM - Australasian Institute of Mining and Metallurgy
- DFI - Deep Foundations Institute
- IMMS - International Marine Minerals Society
- NIOSH - National Institute for Occupational Safety and Health (USA)
- SAIMM - Southern African Institute of Mining and Metallurgy
- SME - Society for Mining, Metallurgy, and Exploration
- TMS - The Minerals, Metals & Materials Society.

OneMine's approach is to make available documents free to members of participating societies. (OneMine is a benefit included in the cost of membership of participating societies.) The funding of OneMine comes from annual fees paid by participating societies, sales of documents to non-members, sales of advertising, and corporate/library subscriptions.

The goal of OneMine is to collect the most relevant and reliable aggregation of technical papers associated with mining and minerals in one, easy-to-navigate location. Anyone can search OneMine. Members of participating societies can view, download, and print documents at no charge. If a user is not a member, they can choose to purchase papers individually.

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Conclusions

It is in the best interests of authors and readers, and society at large, to ensure that scientific and technical papers are searchable and freely available to as wide an audience as possible. It is argued that this can be done effectively by scientific and technical societies who are willing to publish their papers online using one or another variant of the open-access model.

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