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GEOSTANDARDS and GEOANALYTICAL RESEARCH

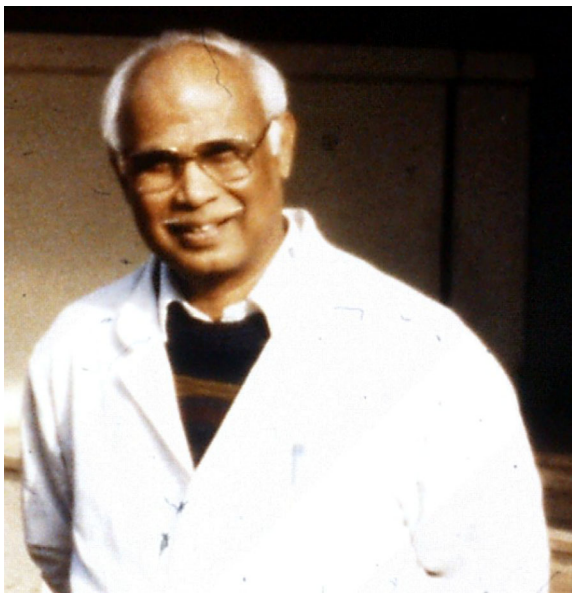
Obituary

Kuppusami Govindaraju (1928–2025) – Founding editor of Geostandards Newsletter

With sadness we report that Kuppusami Govindaraju, or Raj as he was universally known by his scientific colleagues in France and across the World, passed away in January this year. Raj was arguably – and certainly in the European sphere – the pre-eminent figure in developing geoanalysis as a recognisable scientific discipline and in particular pioneering methods for the production and characterisation of geological reference materials. Over a four-decade career in geoanalytical science he was significantly involved with, or was responsible for, the running of collaborative scientific networks, such as the Association National de la Recherche Technique (ANRT) and the Groupe International de Travail-International Working Group (GIT-IWG), as well as being instrumental in establishing and developing the Service National d'Analyse des Roches et Mineraux (SARM) for the CNRS at the Centre de Recherche Pétrographiques et Géochimiques (CRPG), Nancy, after being the group leader of the spectrochemistry laboratory since 1958. Stemming from these activities Raj also conceived the idea of founding this journal (which he called *Geostandards Newsletter*) to support the needs of the developing field of geoanalysis – with particular focus on publishing quantitative information on reference materials, or *geochemical reference samples* as he early termed them. Indeed, his lasting legacy is likely to be the establishment of Geostandards Newsletter (now published as GGR) as the premier publication resource for geoanalytical developments, an achievement of which he was likely to be most proud.

Govindaraju was born on the 24th of October 1928 at Pollachi in south-western India. Following the completion of his secondary education in 1946, he undertook a five-year course of study in Chemistry and Physics at the Annamalai University in south-eastern India, and was awarded a BSc degree (First Class Honours) in 1952, which was followed by a MA in Chemistry (First Class) from the same institution in 1955. He worked from 1954 to 1957 as a chemist and spectroscopist in the laboratories of the Geological Survey of India at Bombay (now Mumbai), devoted to the analysis of minerals and silicates. It appears to have been here that Raj had his first contact with the geological materials that would play such a role in his career. In February 1957 he moved to France to undertake a scientific internship (as a "stagiaire" in the French system) at the Ecole Nationale Supérieure de Géologie Appliquée et de Prospection Minière in Nancy, which was then under the direction of Marcel Roubault (1905–1974), who was also the founder and Director of the CRPG. Raj started his first appointment in the Laboratoire de Spectrographie at the CRPG. From a very early stage Roubault recognised Raj's skills in spectrography and became (along with his Deputy Director Hubert de la Roche, 1925–2020) both a great supporter and scientific collaborator. Such was his immediate standing in the CRPG that, when after the unexpected departure of the head of the spectrography section, Govindaraju was appointed to lead the laboratory – much to his own surprise, as he hinted in his final editorial (Govindaraju 1996b).

In this early period, in the words of Marcel Roubault, Raj "addressed the complex problem of quantitative analysis of silicate rocks of varying composition, and at the same time made an essential contribution to the study of industrial applications for the analysis of slags and refractory materials". The latter reflected the applied science ethos as well as the academic, which characterised the CRPG and



Kuppusami Govindaraju in front of the CRPG in the 1990s. Photograph courtesy of Phil Potts.

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associated institutions in Lorraine (known at that time for its steel industries) in its early days. The work he undertook led to the publication of several papers largely in French language journals, but all along he had been working towards a further higher degree. On the 9th of June 1964 he defended his Doctoral Thesis, entitled "Rapid analysis of rocks and minerals by spectrography and photoelectric spectrometry" (Govindaraju 1964), and obtained his degree from the University of Nancy (with "mention Très Honorable"). Roubault commented on Govindaraju's work: "... the very well-documented report presented by Mr. Govindaraju therefore provides a sum of results which are not isolated successes of varying significance, but the fruit of methods carefully designed, regulated in detail and tested at length for the routine analysis of a large number of samples. This first large-scale application of quantometry to the analysis of rocks bears witness to the qualities of its author as a researcher and experimenter".

Following the foundation of the CRPG in 1953, Marcel Roubault had initiated a programme for the preparation and chemical characterisation of geological reference materials, and installed instrumentation for measurements. This was the context into which Raj Govindaraju found himself situated from the time of his arrival. There would follow a long and productive period in which Raj led the development of the analytical capability of the CRPG laboratory by establishing a methodology involving multi-element determination from rock and mineral samples by a number of techniques, including atomic absorption spectrometry and later by atomic emission spectrometry, as well as pioneering methods for rock dissolution, involving lithium borate fusion. This culminated with the establishment of the SARM – a nationally accredited facility – at the CRPG in 1972, of which Govindaraju was the principal person responsible. The laboratory was progressively configured to maximise the potential for automation of chemical procedures and measurement, as well explained in his 1987 paper with colleague Guy Mevelle (Govindaraju and Mevelle 1987). Raj was clearly innovative in developments in automated geochemical analysis, and indeed technically significantly advanced in comparison with many other laboratories operating in this area.

In parallel with technical developments in the laboratory Raj was closely involved with local collaborative (CRPG-based) then national (ANRT) collaborative work undertaken to produce and characterise a suite of reference materials – minerals and rocks (see Table 1) – the earlier of which were of local provenance, in particular the Vosges Mountains, and the later of which were from further afield. Across these years at least twenty-six reference materials were produced, and full details were published in a suite of peer-reviewed scientific articles and reports. Notable is the thread of common interests and collaboration with CRPG colleagues Hubert de la Roche and Marcel Roubault (see the list of scientific articles 1960–1993, below). After first being involved with a working group supported by the ANRT, Govindaraju and colleagues decided (in 1976) to convert this to an international effort, so at the start of 1977 the 'Groupe International de Travail-International Working Group (GIT-IWG) – with a subtitle of *Analytical standards*

Table 1.
Reference materials developed by Kuppusami Govindaraju and colleagues in the years 1963 –1996 in association with 'local' (CRPG), national (ANRT, 1968 –1976) and international (GIT-IWG) organisational efforts

CRPG			ANRT			GIT-IWG		
RM	Mass (kg)	Year	RM	Mass (kg)	Year	RM	Mass (kg)	Year
Granite GA	40	1963	Diorite DR-N	850	1968	Anorthosite AN-G	900	1980
Granite GH	110	1963	Serpentine UB-N	500	1968	Basalt BE-N	850	1980
Basalt BR	10	1963	Bauxite BX-N	1300	1969	Granite MA-N	950	1980
Biotite Mica-Fe	45*	1967	Disthene[a] DT-N	1300	1969	Albite AL-I	180	1983
Phlogopite Mica-Mg	75*	1968	Glass VS-N	10	1973	Iron Formation IF-G	740	1983
			Granite GS-N	900	1974	Granite AC-E	290	1987
			Feldspar FK-N	520	1974	Chromitite CHR-Pt+	200	1992
			Glauconite GL-O	28*	1974	Chromitite CHR-Bkg	200	1992
						Trachyte MDO-G	200	1992
						Trachyte ISH-G	200	1992
						Dolerite WS-E	300	1993
						Microgabbro PM-S	400	1993
						Zinnwaldite ZW-C	350	1993

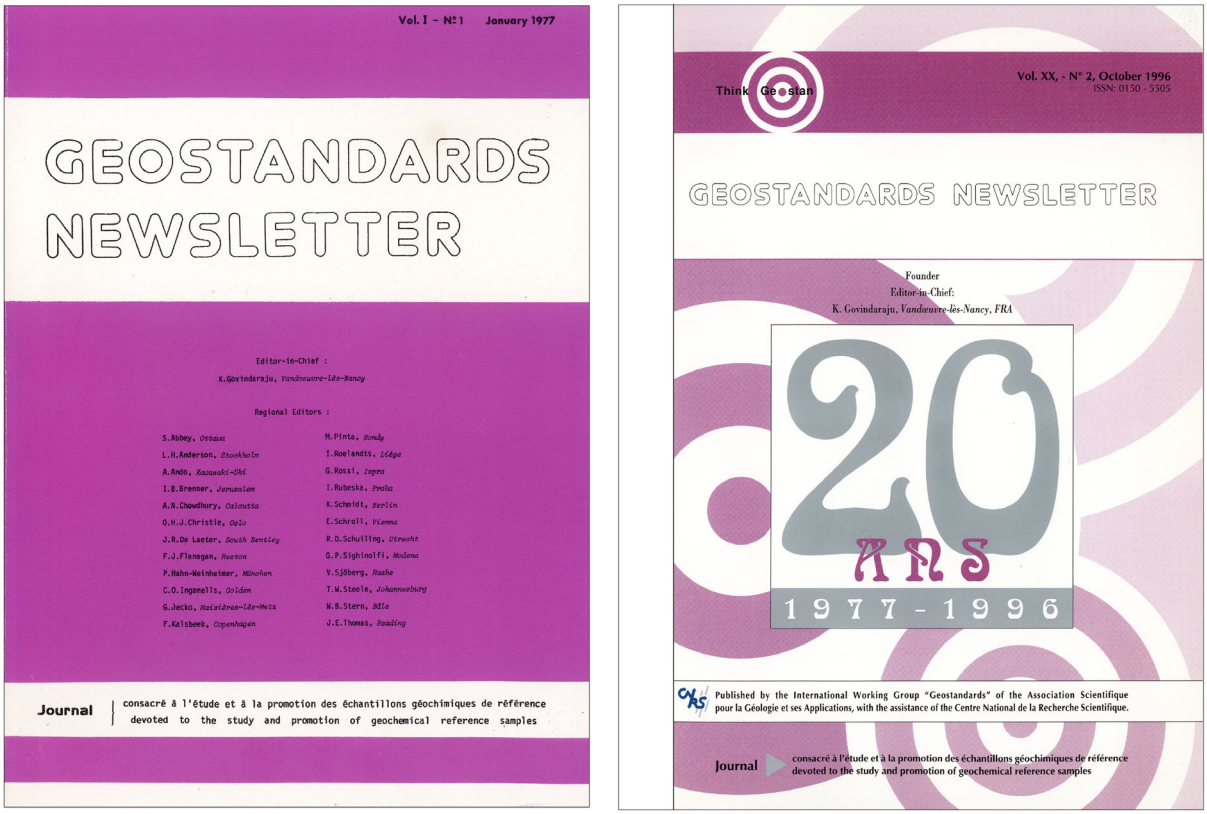
* As grains and powders.
[a] Kyanite.

of minerals, ores and rocks began work. This structure exploited the advantages of a larger network of international (academic and commercial) laboratories, which by 1993 numbered over 400 in forty countries, producing and characterising thirteen more reference materials. This collaboration continued until 1996 and was only dissolved when Raj finally stood down and retired (Govindaraju 1996b). Much of the scientific output of the GIT-IWG was published in Geostandards Newsletter, the journal that Raj conceived to support this organisation and the wider geoanalytical community.

Geostandards Newsletter

In his own words, Raj Govindaraju detected the need and potential for a new and dedicated journal focussing on geochemical reference material research when he noted a trend for mainstream geochemistry journals to limit, or no longer consider for publication, submissions on these topics (the publishers no doubt being disinclined to print extensive data tables of analytical measurement results that were essential in reference material characterisation studies). Thus, in the same period as the decision to form the GIT-IWG was taken, in 1976 the GN project was also launched. A twenty-four-member 'board of editors' was assembled within 3 months, and the first issue published early in 1977 – thus achieving the creation of a viable journal in just 12 months (Govindaraju 1977a). His Editorial Board, which he styled 'Regional Editors', was instrumental (at his urging) in providing articles for the first issue but thereafter, external submissions began to arrive. Govindaraju was able to attract to the board the foremost researchers in the 'geoanalytical' field of the time, including Sydney Abbey, John de Laeter, Frank ('Father') Flanagan, Charles Ingamells, Iwan Roelandts, Ivan Rubeska and Trevor Steele. He selected a truly global team reflecting perhaps his connections and contacts worldwide built up over his career to this point. The very international composition of the team of scientists comprising the Editorial Board remained a characteristic to the last volume with which he was involved; indeed eleven of the original board remained until 1996.

Raj Govindaraju set out the means of realising the aims of GN – briefly, to act as a forum for the exchange (and dissemination) of ideas and information – in the second



First and last issue front covers of Geostandards Newsletter.

editorial ('Mission') he wrote in 1977, with an intense focus on 'capturing the market' in papers dealing with geochemical reference samples (Govindaraju 1977b). This concept he had placed prominently on the journal front cover from the start: "Journal devoted to the study and promotion of geochemical reference samples". But he also stressed the need to foster collaboration and cooperation, and encouraged submission of 'Letters to the Editor' and Discussions, as well as publishing news items, announcements and calls for participation in scientific projects. In 1981 he introduced *GeostandardRef Corner* to the journal – an annually published collection of all articles relevant to geochemical reference samples and their analysis (including brief summaries, and an index linked to the chemical elements). This proved to be an essential compendium in the days before electronic publication and the Internet. *GeostandardRef Corner* was compiled and written for many years by Raj Govindaraju's close collaborator on the editorial board Iwan Roelandts. His early journal published a majority of papers in English, but with notable numbers of French language papers reflecting its origins, but over time English became the norm – reflecting Govindaraju's international intent. All papers however were published with French abstracts for many years.

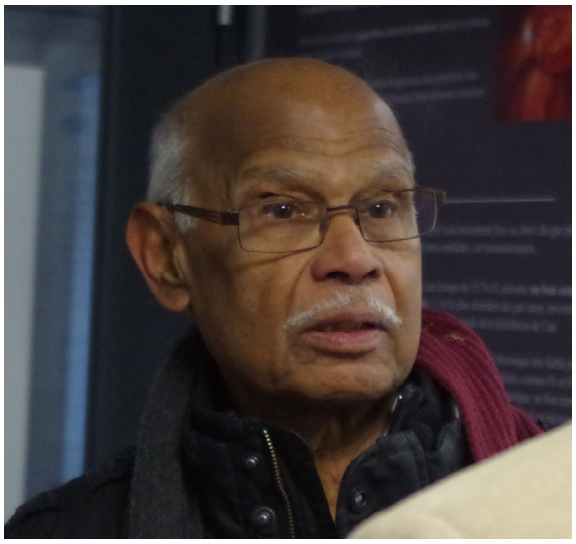
One remarkable aspect of Geostandards Newsletter under Raj's tenure was that the Journal was not published by an established commercial publisher but was produced entirely in house at the CRPG under Raj's direction. Thus, Raj effectively worked as both Managing Editor and Editor-in-Chief throughout his twenty years at the helm. Subscriptions, management and distribution were run from the Publication Office, and the printing too took place on site. Raj became an early adopter of desktop publishing software and other computing products, and exploited these not only to electronically typeset the journal, but also to develop a suite of innovations, such as the GeoSTAN databases (Govindaraju 1992, 1993) – containing digitised information on measurand values for reference materials – and GNindeX, his database of titles, abstracts and authors of all papers published in GN.

Govindaraju worked to gain material support for GN, and it was published for much of his time in charge under the banner of the International Working Group "Analytical Standards of Minerals, Ores and Rocks", with the assistance of the CRPG. At other times he also enlisted the (financial) support of UNESCO and the International Association of Geochemistry and Cosmochemistry, but the journal was fundamentally supported by the considerable list of subscribers that was built by his organisation.

The success of the journal was clear in terms of the Impact Factor and ranking it achieved amongst comparable journals in the geochemistry field. By 1990 for example, GN hit an Impact Factor of 3.088 and a Rank of 6th amongst top geoscience journals (and 260th out of 4000 science journals that year). In his long retirement Raj continued to receive every issue of the Journal, reports on its progress from the Publication Office and took a keen interest in the Impact Factor it achieved. He was supportive of the title changes we introduced, first to *Geostandards Newsletter: The Journal of Geostandards and Geoanalysis* in 1997 (designed to show that the Journal was a 'proper' scientific journal, but retain the GN legacy), then to the more concise *Geostandards and Geoanalytical Research* in 2004.

Publication record

At the same time as running Geostandards Newsletter, the SARM and the GIT-IWG, Raj Govindaraju undertook research on RMs he had himself been involved in producing as well as working on other reference materials and producing large-scale data compilations. His formidable research output is summarised below in two lists containing his publications in Geostandards Newsletter and articles in other journals and books. His publications in GN are notable for thirteen or so lengthy and detailed papers on CRPG, ANRT and GIT-IWG reference materials that were often styled as 'compilation reports', under his sole authorship or with collaborators. Notable also was the production of the four Special Issues of Geostandards Newsletter (which he designated 'SIGNs') published in 1984, 1989, 1994 and 1995 (Govindaraju 1984b, 1989a, 1994, 1995b). These separately printed issues of the Journal were, for the time, state-of-the-art compilations of measurement results for hundreds of reference materials. The scientific value of the SIGN series is clearly reflected in their citation success – with a conservative aggregate figure of over 4000 citations, and their relevance remains strong as evidenced by frequent citation in the 2020s to the present day. A non-exhaustive selection of Raj's publications has over 6000 citations. It is also noteworthy that he published his research on measurement techniques and analytical methods away from GN in other journals and outlets, and these articles number over 45 (see the reference list below). Raj was also very active in presenting research results at various conferences, colloquia and meetings – several of which he organised. From 1968 to 1980 he gave over 30 such presentations. In the 1960s and 70s he also acted as an expert (for the UN and the Coopération Technique Française) in installing and consulting on spectrographic laboratories in Quito (Ecuador) and Abidjan (Ivory Coast).



Kuppusami Govindaraju at CRPG for the inauguration of the new SARM Spectrochemistry laboratory in 2015. Photograph and caption courtesy of Delphine Yeghicheyan.

Awards

Kuppusami Govindaraju was awarded the *Palme Academique* in 1982, and in 1993 *Le Cristal du CNRS* – the latter recognising research engineers "who have brilliantly contributed to the advancement of science and technology". He was amongst the first to be awarded this distinction and of the seventeen laureates in 1993 the only one from the CNRS Institut National des Sciences de l'Univers (INSU). He received the award at a ceremony in Paris, in the presence of the then Minister of Research and the Director General of the CNRS, from Professor C.J. Allègre. William L. Brown (CRPG Director) wrote at the time that the 'award of *Le Cristal du CNRS* recognised a long and distinguished career' and highlighted Raj's great achievements, both in analysis and in the journal Geostandards Newsletter. We were also honoured when Raj accepted an invitation to attend *Geoanalysis* '94 (Adkins 1995) as a guest presenter and an honoured participant in a following reference materials workshop. The organiser of the workshop clearly remembers forgetting to introduce Raj at the start of the workshop, the (feeble) excuse being that it was unnecessary as Raj's reputation went before him as a scientific 'A-lister'.

Although retiring officially due to the then age limit in October 1994, Raj prolonged his working career until 1996, continuing to edit and manage the journal, as well as publishing several further academic papers and completing work on his GeoStan series of databases. He was very generous in passing on the control of the Journal to the next generation of Editors-in-Chief offering only support, despite the fact that the credit for the existence of the journal and its high reputation could be solely claimed by himself.

When assessing Raj's legacy, there are few scientists who can claim to have established a Journal that has evolved into sustaining research influence as is the case with GGR. However, in founding Geostandards Newsletter, Raj was a pioneer in recognising that as new and more powerful instrumental techniques were developed, supporting ever more influential geochemical research studies, there was a clear need to establish well-characterised reference materials. Without such well-characterised materials, conflict was likely to occur in the interpretation of geochemical data produced in different laboratories. In promoting Geostandards Newsletter, Raj also established the legitimacy of reference material studies as a key component of the geoanalytical sciences. Not a bad achievement for a scientist who started his career as a 'stagiaire'.

Edward A. Williams, Philip J. Potts

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