SACNASP Registered Scientist Survey to Earth Science and Geological Science Fields of Practice – June 2021

Report of Results

Background

Concerns have been raised about employment opportunities for geologists in South Africa, and in particular whether South African universities are producing too many Honours level graduates relative to employment opportunities available. There are concerns that a separate issue, the unattractiveness of South Africa as an exploration destination (as opposed to mining) is one of the causes of a perceived lack of employment opportunities in industry. The first issue is addressed in this report, with some comment about the application of survey results to the second issue.

There is conflicting opinion as to whether the universities are graduating too many geologists. The academic community in general believes this is not the case, and that most of their graduates are finding employment. In support of this view, the GSSA SACNASP registration committee is processing large numbers of applications (of the order of 200 to 300 annually) of which a large proportion are for Candidate status, and except for very recent graduates many if not most of those are employed. Some senior people in the resource industries agree with this view, but note that there is a shortage of talent at more experienced levels.

The view that South Africa is producing too many geologists is based on large numbers of solicited and unsolicited job applications being received particularly by consultants and consultancies.

It makes no sense to survey the GSSA membership on this issue, because we will sample the wrong universe. GSSA members tend to be employed, and a majority of the SACNASP registration applications we receive indicate that applicants are not affiliated to a professional society, particularly at Candidate level. To sample the correct universe, the survey was run through SACNASP, sent to all registered members of the Geological and Earth Science Fields of Practice.

<u>The Survey</u>

The survey was designed around 15 simple questions, using Survey Monkey as the platform. As of February 23, there were 952 respondents from about 2845 recipients, which is a very good result. The majority of responses were received in the first three days. The results are appended as two pdf files, one being completely unfiltered and the other filtered for SACNASP registration level, covering Candidate status only. The people registered as Candidate number

248 of 952 respondents (26%) and is the young professional group we are most concerned about.

What we did not anticipate was that the survey would be circulated further by SACNASP registered recipients via social media. This has happened, and we cannot be absolutely sure what proportion of the respondents are not SACNASP registrants. However, Question 1 in the Survey asked for level of SACNASP registration, and was answered by 930 respondents, leaving just 22 that may not be SACNASP registered. This will not affect the results and we can conclude that the correct universe was sampled.

<u>Results</u>

All diagrams a well as the raw data can be found in the attachments.

Q1 – Level of SACNASP Registration

The results are as expected based on what the GSSA registration committee has received over the past few years. There has been a marked increase in the proportion of Candidate applications in the last year, however. Note also the low proportion of Certificated (three year BSc degrees or equivalent). In general, there are larger numbers of three year BSC's who cannot find places in an honours program, and this survey provides no insight as what happens to them. As regards employment, the group to focus on is the Candidate category comprising mainly young professionals recently graduated (284 respondents).



Q2 – Age Group of Respondents

The majority of respondents (37%) are between 31 and 40 years of age, distinct compared to the GSSA membership profile which is skewed to older age categories. At least part of the reason for this is that the GSSA membership includes retirees who are no longer registered with SACNASP. The 20-30 year age group comprises 30% of respondents. Within the Candidate group (N = 284, not shown), 79% are between the ages of 20 and 30.



Q3 – Gender of Respondents

Females comprise 33% of all respondents, but 49% of the Candidate category. This is in agreement with the steady increase in female members of the GSSA over the last several years. Amongst younger professionals, there is close to gender parity.

Q4 – Years Experience of Respondents

The majority of respondents (37%) have 5-15 years' experience. Of the Candidate category, 84% have less than 5 years, as would be expected for this category, which comprises mostly young professionals at the start of their careers.





Q5 – Highest Qualification of Respondents

BSc Hons level respondents comprise 53% of the total, and MSc level respondents are 31%, slightly higher than expected. Four-year degrees are a higher proportion within the Candidate category alone, at 67%. This may reflect the more recent increase in Candidate status applications. The lack of PhD registrants in the Candidate category (only 1) may indicate lack of PhD graduates compared to prior years (75 PhD holders in all registration categories, and/or that South Africa is losing PhD graduates to emigration. If the latter is correct, it can be inferred that industry is not hiring at PhD level, and that there are not enough academic posts in South Africa to retain these valuable and expensive skill sets.





Q6 – Which university was Your Highest Degree Obtained From

As expected this is spread across South African institutions, but there are 135 no responses, but a significant proportion of the those may be from the University of the Western Cape, which was inadvertently left out of the survey response options. Additionally, a significant number may have a qualification from a foreign university. This is a relatively small proportion, and is likely over weighted in the academic sector. Within the Candidate category alone, the non-respondents numbered 30 of 254 (12%). The implication is that circa 5 to 10 % of SACNASP registered geologists have foreign qualifications, in turn suggesting that a relatively

low proportion of geologists working in South Africa are non-South African. This question does not shed light on how many South African geologists have emigrated, and this is probably a significant number. The distribution across universities approximates what was expected, and does not differ appreciably for the Candidate registration status alone.



Q7 – Which Province do you Reside In

The results are in line with expectations. Gauteng is the center of the geological universe as far as South Africa is concerned. The Candidate status distribution is virtually identical to the full sample. What this does not show is the provinces where most geologists are actually working; currently there are numerous corporate employees who live at the coast but commute to Johannesburg or other work sites on a weekly basis. Further, a high proportion of geologists will be working in many different locations. The low number of non-responses (38 of 1061) suggests that relatively few of the respondents live outside RSA.



Q8 - Time Needed to Find First Job After Graduation

This result was unexpected, given the anecdotal evidence that too many geologists across all categories are searching for work. 70% of all respondents found employment within a year of graduation; but only 14% have not found employment at all. Most of these are the younger professionals with Candidate registration status. The proportions are quite different for the 284 Candidate category respondents. Only 35% found employment in the first year; an additional 39% have not yet found employment at all. The true picture is probably worse, because the survey will have captured only the SACNASP registered earth scientists. Many young professionals apply for registration status only on employment. The Candidate registrants (the youngest professionals) are stressed, suggesting that in the current market, universities are feeding four-year graduates into the market at roughly double the job vacancies. The reasons for this could be varied and a common complaint from employers is that graduates are not well enough qualified, and/or graduates have expectations of their first jobs that are unrealistically high.

In 2020 and 2021, first year student numbers in Earth Science curricula have dropped sharply, and this is a global trend. In South Africa the most likely reason is that companies are hiring fewer graduates, and consultancies cannot take up the excess despite the proliferation of consultancies.

The GSSA has not yet attempted to survey employers to ascertain future staffing needs, but meaningful results may not be possible due to several factors, including the cyclical nature

of the resource industry and the uncertain and to date the investor-unfriendly national policy framework on exploration.





Q9 – Do Respondents Believe they are Underemployed

A higher proportion of Candidate (younger!) respondents believe they are underemployed or overworked (55 %) than for the entire sample (43%, which includes the Candidate category). It is suggestive that graduates come into the job market with unrealistically high expectations of employment benefits and/or level of employment. See attachments histograms.

Q10 – Nature of Employment

A percentage of the respondents are in full time permanent employment (60%). This reduces in the Candidate group to 46%, with over twice the per centage in contract positions (19% all groups compared to 39% in the Candidate category. Clearly, the younger professionals have more difficulty in accessing permanent employment, though this might be expected at an early career stage. Note that a significant proportion of respondents did not answer this question (15% of all registration categories; 35% in the Candidate category). The number of non-respondents to this question closely correlates with the 'not found employment' in Question 8; these results seem to indicate realistic unemployment levels.



Q11 – Employment Sector

In all registration categories, 213 skipped the question, suggestive that 19% are either unemployed or are in non-earth science career streams (see Q10 and Q8). Academic employment is only 5% of the total, and at 42 responses is significantly lower than the total staffing in the universities which has been previously estimated at about 250 nationwide. The academic sector is not registering with SACNASP, in general. This corroborates anecdotal evidence from two universities which supposedly have legal opinion that academics who do not consult need not register. This issue will need to be resolved at institutional level.

The two key employers are the consulting industry (30%) and mining (33%). The inference is that the large corporates are hiring far fewer geologists than a decade ago, with the consulting industry having grown significantly. It can be inferred that the larger companies are outsourcing more work to consultancies. Whether this is strategically sound, or whether universities are preparing students for this is debatable.

Note that companies focused on exploration employ the lowest number of people at 5%. There is a perception that regulatory change enabling and attracting greater investment in exploration will lead to increased employment in the exploration sector. The GSSA doubts this, because exploration focused companies are operating with reduced permanent head count and more reliance on consultants or contractors.

The government sector employs a significant portion (10%).

The Candidate category profile is similar (graph not shown), but a higher proportion are employed in the government sector (17%). Employment of Candidate level people by exploration companies is miniscule.

This is a very different profile than would be the case in the United States and Europe, which would have a higher proportion employed in government and academia.



Q12 – Commodity Sector

Responses are spread across the spectrum, but geohydrology and engineering geology are significant employers (> 20%). Geophysics and Environmental Geology were not given as choices, but are likely see growing demand. The Candidate profile is very similar except that a higher proportion of candidate registered professionals are is working outside of the Earth Sciences (20% vs 9%). It can be inferred that younger professionals are more prone to work outside their Fields of Practice, but the reasons for this are uncertain. The GSSA suspects that both lack of jobs in the traditional sector as well as the greater demand for cross disciplinary talent is driving this trend. The Information Technology sector may be cannibalizing earth sciences and other disciplines as far as employment is concerned, for example. The implication is that Geology departments need to change their curricula to better facilitate employment outside of the subject. Similarly, SACNASP registration criteria need to adopt to these trends. Independent surveys by the AGI in the United States indicate that large numbers of graduates are entering various data science careers, but only about half of university departments are teaching the relevant subjects. (see AGI Data Brief of June 18, 2021 at www.americangeosciences.org/geoscience-currents.) Long term, if Earth Science departments do not change the curriculum offerings, departments may become irrelevant and ultimately be closed. This is happening in Australia currently.

This question has not included some earth science fields such as environmental geology, and also does not cater for academic research, and is likely the reason 273 of 1061 respondents skipped the question.



Q13 – Professional Affiliation

This was a poorly worded question, and we suspect that SACNASP registration was included by many respondents as professional affiliation. In the overall group, 81% are members of a professional or registration body. Even so, note that a lower proportion of the Candidate group claim professional affiliation (63%).

Q14 - Unemployed Actions

The key finding is that the number of responses dropped to 489 from 1061, indicating a significant proportion (54%) of geologists who are either unemployed as temporary contractors or free lancers do not consider themselves employed. This is significantly higher than the unemployment rate indicated by questions 8 and 10, and it is inferred that professionals who do not have permanent positions also responded to the question. Within the Candidate category, a higher proportion are seeking employment for the first time or are looking to move (63%). This should concern employers and educators alike. The majority of those seeking employment are seeking jobs within the earth sciences (52%), but 20% are either seeking employment in other fields or are re-training in other fields. A surprisingly high proportion is not looking for employment at the present time, and based on responses to question 2, this would include a relatively low number of retirees. This may be a temporary aberration due to the COVID pandemic. The responses for the Candidate category are similar to the overall group except that the response number is very similar to that in question 10.



Q15 – Employment outside geoscience

The response to this question raises alarm bells with a very high percentage of respondents either seeking employment outside the earth sciences or considering doing so because they perceive a lack of opportunity in the profession. Across all registration categories, 55% cite lack of employment opportunities. Within the Candidate category, this is a disastrous 81%. 26% of respondents believe that opportunities are better in other fields and many are actively searching to leave the profession. It must be noted that the response to this question is heavily skewed toward the unemployed; there is a clear perception in this group that there is a lack of opportunity.





First Order Conclusions and Inferences

South African universities are currently producing too many four-year graduates for the job market by a factor of about two. Current indications are that the unemployment rate amongst all categories of SACNASP earth scientists is around 15%, with the majority of those being young professionals with Candidate status. Within the Candidate status the unemployment rate is about 35%. A significant number of respondents indicate there is a lack of employment opportunity.

This is in sharp contrast to a global and local drop in student enrollment in Earth Science programs, endangering the survival of some departments, particularly problematic given that the green economy will require increased levels of minerals extraction, according to some.

The drop in student numbers is typically ascribed to an image problem of the earth sciences, which students viewing geology as part of the problem rather than part of the solution. But the GSSA believes at least three other factors are important. First, students want to enter fields in which they can be assured of long-term careers. Second, geology departments are not adequately preparing students for the non-academic career paths. Third, industry is no longer championing or supporting the science or the well being of the earth science professions.

Part of the employment problem may be that graduates do not have the right skills for employment in current and future industry job markets. The GSSA sees anecdotal evidence

that companies receive significant numbers of under skilled applicants for the positions on offer, which sometimes cannot be filled. This leads to a large pool of unemployable or underemployed graduates who fully expected to embark on professional careers on graduation, but who end up being unemployable or under employed. The economic consequences to those affected are likely severe. A radical re-think of the academic programs is needed urgently. A curriculum less geared to employment in specific sectors must be changed to allow widened opportunity for graduates. The criteria for SACNASP registration of graduates must be broadened accordingly.

The problem is not an academic issue entirely. The corporates over the last two decades have largely abandoned the role of watchdogs of the technical professions, and cut back on internal high level human capital development, particularly in the technical disciplines so necessary to their success.

The shift in employment patterns to the consultancies is marked, as this sector is now the major employer of graduate earth scientists. The consultancies do not have the resources to take on the needed development role, though some are certainly trying.

The GSSA is not convinced that change in the regulatory environment to attract investment in exploration will lead to significantly expanded permanent employment opportunities for geologists in South Africa, because of the nature of modern exploration. It could result in expanded opportunity for contract employment via consultancies.

The academic sector seems to be resistant to SACNASP registration – by a factor of four or five.

Final Comment

This survey should not be taken as gospel indications of trends in earth science employment in South Africa. There is much more analysis that can be done, and a key missing component is the employment needs of industry. The METF may have data from its member companies, but the GSSA is not privy to the information. Another key area of uncertainty is the number of graduates produced in South African universities who further their academic careers internationally. Who has access to those opportunities, and how can this be expanded? Do university departments track the careers of their graduates and adjust programs accordingly.

Not addressed in this survey are the issues of B_BBEE and gender equality, and the GSSA believes this is progressing well in both academia and industry. But it has not been measured in other than an anecdotal or ad hoc manner. The GSSA membership trends reflect very positive progress, but GSSA membership and SACNASP registration is estimated to cover only about half the earth science universe in South Africa.

Craig Smith June 21, 2021