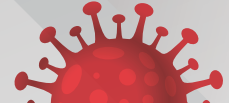


## Preface: The COVID-19 Pandemic and Mineral Resources

Jean Cline, *President, Society of Economic Geologists and*  
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Pandemics are one of the few events that are truly global and affect all of humanity. Even World Wars I and II, as terrible and far-reaching as they were, did not affect all corners of the globe, and certainly not equally. Pandemics are different, especially in light of modern transportation and the interconnectedness of global business, education, and supply chains. One does not have to be a major participant in the global economy or even be aware of the disease at all to be affected, infected, or possibly killed.

Although the long-term effects of COVID-19 are not yet known, there are few in the minerals sector who have not been affected, whether it be by the loss of a loved one or by the economic

fallout of attempts to contain the disease. Many universities and mines are closed, research and exploration budgets curtailed, and most travel halted. At the time of writing, no one knows how the pandemic will evolve—are we past the worst of it or are there new waves coming?

Following this preface are two rapid-response articles to offer a preliminary assessment of the impact of COVID-19 on the minerals industry and all of us who are connected to it. The first article, by Hitzman et al., reports the results of a survey about the pandemic's effects on the lives, education, and business of people in the minerals industry. Although necessarily limited in scope, it provides

a snapshot in time that sets the stage for the second article, by Simon Jowitt, that offers a preliminary economic analysis of possible effects on prices, stocks, and supply and demand within the minerals industry.

The phrase “the new normal” has been used frequently to describe the effects and after-effects of the COVID-19 pandemic. The following two studies are complementary and provide a framework for assessing where we are today and for beginning the process of planning for the future. Although it is likely that both articles would be written differently a year or two from now, they are presented here while the pandemic is still unfolding to provide the view from July 2020.

## Impact of the COVID-19 Pandemic on the Minerals Sector: A Real Time Survey

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### Abstract

Through the implementation of an online survey, run at the end of April 2020, researchers at the Irish Centre for Research in Applied Geosciences (iCRAG) explored the immediate effects of the COVID-19 pandemic on the minerals sector workforce. With more than 1,000 respondents, the survey provides insights into the impact of an unprecedented global event at a crucial point in its development. Seven weeks after the World Health Organization's declaration of the pandemic, 65% of survey respondents agreed that COVID-19 had a significant impact on their work. Overall, 32% of respondents had experienced negative impacts on their employment, having either lost their jobs or been furloughed/temporarily laid off, or were working reduced hours.

Geographically, the greatest impact on employment was in Africa, where

45% of respondents suffered negative effects. More often, younger respondents (ages 18–30) reported lost jobs (14%) whereas older survey participants reported working reduced hours (21%, ages 46–60). Respondents working in mineral exploration were most affected (40% suffered negative job impacts), but the impact across base, industrial, and precious metals was broadly similar for all participants; government employees were least affected but were not immune (10% on reduced hours). The level of concern about future job security due to the COVID-19 crisis varied, with 35% of respondents being more or very concerned or having already lost their jobs, 43% had little or no concern, and 22% were moderately concerned. The survey captured the experiences and perceptions of individual workers, providing a perspective different from information available in corporate statements and official statistics.

### Introduction

The COVID-19 pandemic caused by the novel (new) coronavirus affected human activity across the planet in 2020. Early cases of COVID-19 were recorded in China in December 2019 (Huang et al., 2020) and the first cases outside China were confirmed in mid-January 2020 (World Health Organization, 2020a). The World Health Organization (WHO) set up an Incident Management Support Team on January 1, 2020. With increasing numbers of cases throughout the world, the WHO declared the COVID-19 outbreak to be a pandemic on March 11, 2020. Over 10 million cases and in excess of a half million deaths were reported worldwide to the end of June 2020 (European Centre for Disease Prevention and Control, 2020; WHO, 2020b).

Outbreaks of COVID-19 overwhelmed medical facilities in several regions, leading governments throughout the world to enforce restrictions

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to prevent the spread of the illness. Wuhan, the Chinese city of 11 million people at the center of the initial outbreak, for example, entered a 76-day lockdown in response to the virus on January 23, 2020. Measures included closure of non-essential businesses, travel restrictions, border closures, quarantines, social distancing, limits on the number of people who could congregate, and cancellation of many in-person gatherings. Lockdowns to varying degrees were put in place virtually around the world by the end of March 2020 (Hale et al., 2020). Some governments deemed mining and mineral exploration to be essential businesses that could remain open. Temporary mine closures were especially common in Latin America and South Africa, but some operations in the United States, Canada, and elsewhere also reported reduced activity (S&P Global, 2020). Mineral exploration was severely affected by travel restrictions.

To better understand the impacts of COVID-19 on the minerals sector, researchers at the Irish Centre for Research in Applied Geoscience (iCRAG) launched a short online survey at the end of April 2020. The survey was designed to determine the immediate effects of the pandemic on people in the minerals sector and how the effects were distributed in terms of geographic area, sector of the minerals industry, and commodity. The survey asked about the impacts on people's employment, the nature of the impact, and the level of concern individuals had concerning job security due to COVID-19 for the remainder of 2020 (Boland et al., 2020). The survey fortuitously captured data just before many different parts of the world began to open up after a nearly global lockdown. Thus, the results capture opinion at the height of the initial response to the pandemic.

## Methodology

An eight-question English-language survey was created in Google Forms in consultation with an iCRAG social scientist, followed by an ethics review at University College Dublin (Boland et al., 2020). Since Google is not accessible in Mainland China where the pandemic began, a duplicate of the questionnaire, in English, was created through a Chinese survey website. The survey was posted online on April 23, 2020, and was held open for responses until noon GMT on May 2, 2020, allowing people

in other time zones to respond within the May 1 deadline.

A link to the online survey was distributed by the authors via email to their contacts in the minerals sector with a request that they fill out the survey once and pass the link on to others in the mineral exploration, mining, and minerals research sectors. Information about the survey was sent to the economic geology group of the Geological Society of Australia, International Association on the Genesis of Ore Deposits, Irish Mining and Quarrying Society, Irish Association for Economic Geology, Ore Deposits Hub, Society for Mining, Metallurgy & Exploration, and student chapters of the Society of Economic Geologists worldwide. These groups shared the information with members in various ways, including mentioning it online, in member mailings, podcasts, and webinars. iCRAG intentionally did not publicize the survey via social media such as LinkedIn in order to ensure, to the extent possible, that it would remain within the minerals sector.

A total of 1,010 English-language plus 40 Chinese responses were received by the closing date. Of the 1,050 responses, 1,007 contained sufficient information to be included in the analysis. Data from the survey and information on how the data were processed are available on the iCRAG website (Boland et al., 2020).

Choosing to distribute the survey through personal contacts and selected organizations and allowing respondents to self-select means that the survey is not based on a completely random sample and it is thus impossible to estimate the response rate. The survey was designed to be simple and rapid, with an estimated completion time of less than three minutes. In order to minimize barriers to participation and to meet the requirements of our ethical approval, respondents were not required to sign in and all responses were kept anonymous; it is possible that some people could have responded more than once.

## Response Demographics

Responses were received from individuals whose most recent employment spanned 55 different countries. In terms of most recent employment location, the largest response was from those employed in North America (49% of the respondents; Fig. 1A). The second largest response group was from Europe (14%), followed by Asia (7%), Africa and South America

(6% each), and Australia (5%). However, 13% of the responses did not list a country of origin. Respondents were fairly evenly divided by age (Fig. 1B). The largest cohort of respondents (32%) were aged 31–45, whereas 28% were older than 61 years of age, 23% were age 46–60, and 17% were 18–30 years old. In relation to current employment status, 55% reported being currently employed whereas 26% listed themselves as consultants, 10% said they were students, 5% were retired, and 4% reported being unemployed (Fig. 1C).

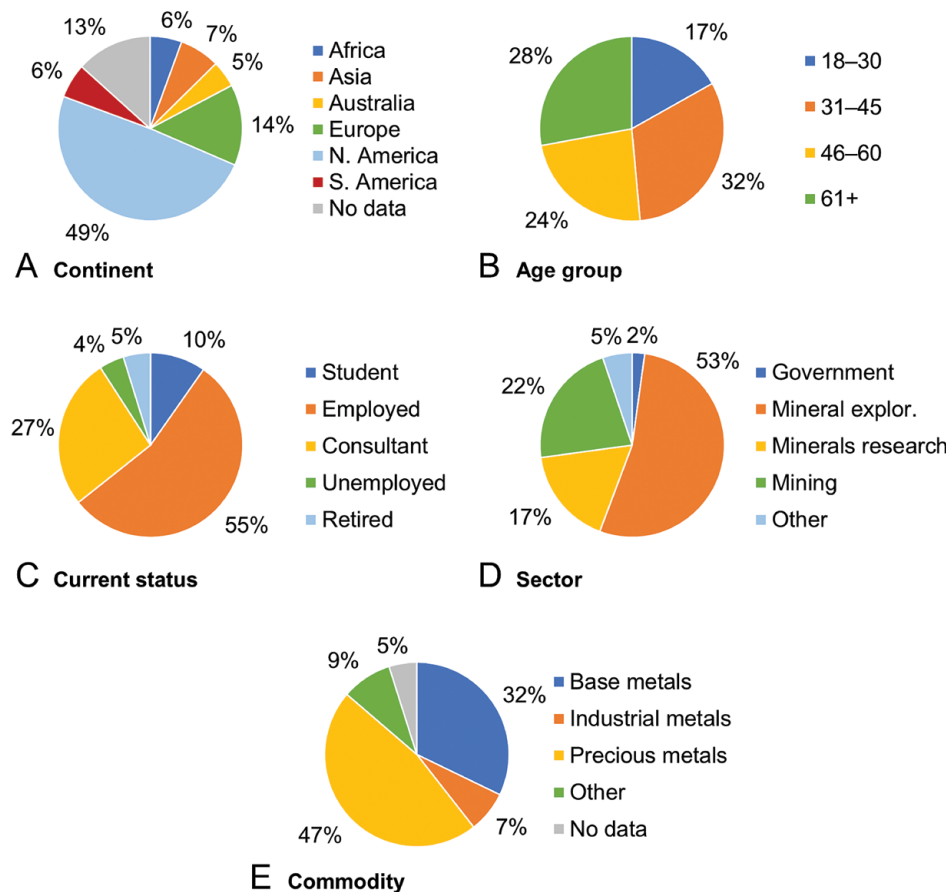
Respondents were asked to identify the sector in which they worked: mineral exploration, mining, minerals research, or other. Some respondents selected multiple sectors, leading to many different combinations; therefore, we aggregated responses in order to simplify the analysis, as explained in Boland et al. (2020). Based on additional information provided by those who chose "other," we created a new category of "government." Following these procedures, the respondents represented 54% mineral exploration, 22% mining, 17% minerals research, 2% government, and 5% other (Fig. 1D). The other category included environment, education, law, services, policy, engineering geology, petroleum, drilling, health and safety, information technology, corporate social responsibility, and water.

For primary focus of work, respondents were asked to choose one option from the following: base metals, industrial metals, precious metals, or other. Where respondents provided details under "other" the responses were classified as "other" if they mentioned a commodity—responses included coal, critical minerals, uranium, potash, salt, construction materials, oil and gas, and helium. If the response indicated support services such as education, software, drilling, they were categorized as "no data" to indicate that they were not linked to a single commodity. Following these procedures, the respondents represented 47% precious metals, 32% base metals, 7% industrial minerals, 9% other, and 5% who were classed as none listed (Fig. 1E).

## Results

The pandemic had a significant impact on people in the minerals sector by the end of April 2020, less than six months after the first cases occurred and within seven weeks of the declaration of a pandemic.

Impact of the COVID-19 Pandemic on the Minerals Sector: A Real Time Survey (continued)



**Fig. 1.** iCrag COVID-19 Survey demographic data. A. Responses by continent. B. Responses by age group. Four responses with no data (<1%) were omitted from the chart. C. Responses by employment type. One response with no data (<1%) was omitted from the chart. D. Responses by employment sector. Two responses with no data (<1%) were omitted from the chart. E. Responses by type of commodity the survey participant was involved with.

**Effect on work**

Survey results indicate that two-thirds of respondents had felt the effects of the pandemic on their work: 37% of respondents strongly agreed that the COVID-19 pandemic had already significantly affected their work, with another 28% agreeing that it had affected their work

(Fig. 2A). Only 14% disagreed or strongly disagreed with the statement that the pandemic had affected their work.

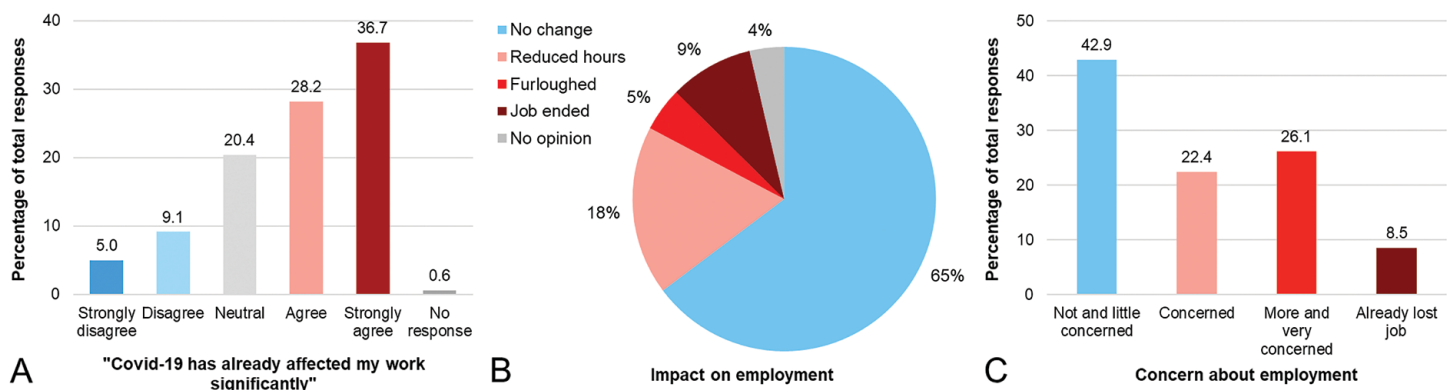
**Effect on employment status**

When asked if the pandemic had had a direct impact in their employment status, 65% said there had been no

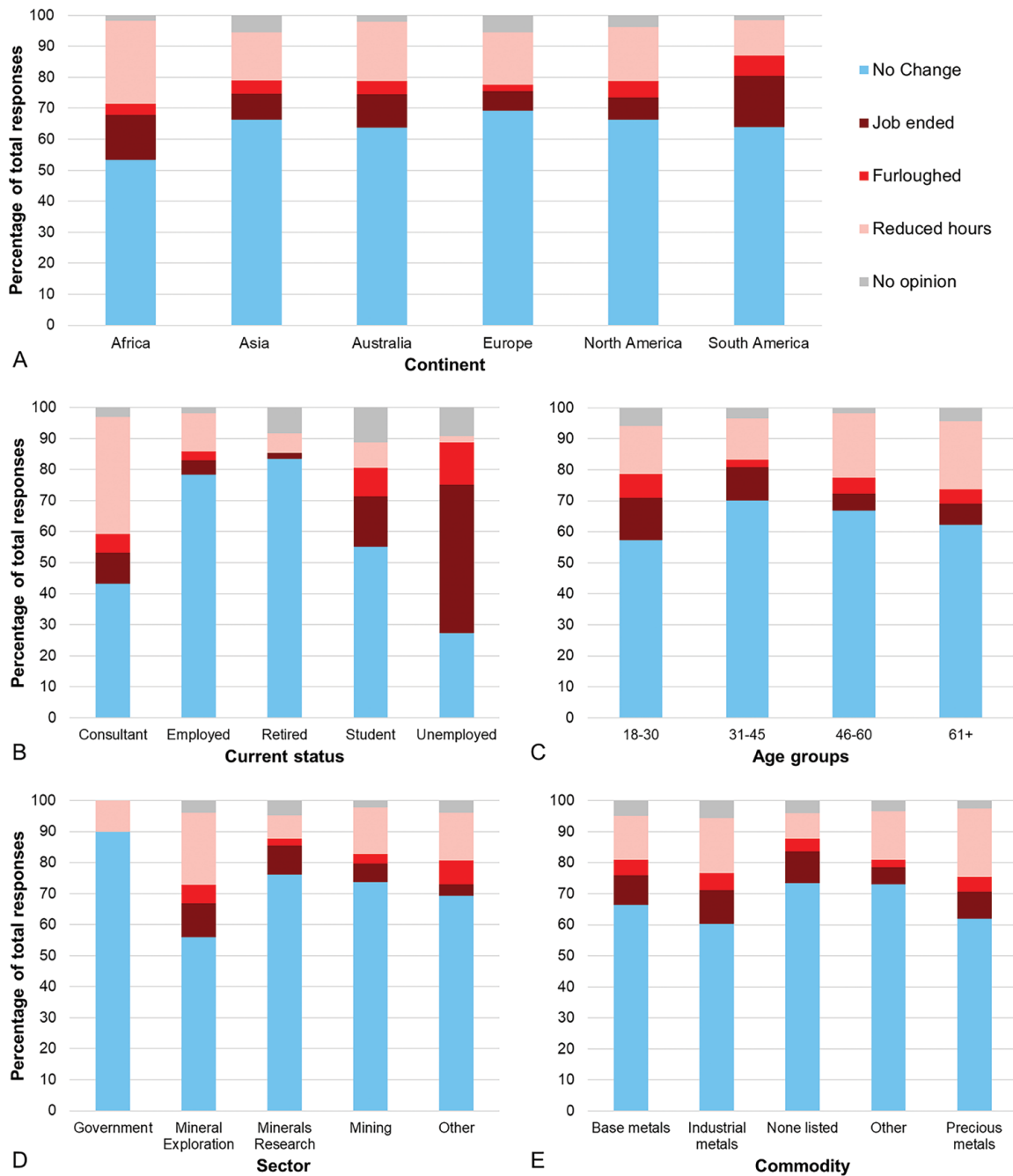
change whereas 18% reported reduced hours, 4% reported being furloughed, and 9% reported having been laid off. Four percent of participants reported “no opinion” (Fig. 2B). The highest rate of change in employment status was from Africa, where 45% of respondents reported negative employment activity, defined as job loss, furlough, or reduced hours (Fig. 3A). South American respondents were next, with 34% reporting negative employment activity. Europe appeared to be the most stable, with 70% of respondents experiencing no change in employment status followed by Asia and North America, where 66% of respondents reported no change in employment status.

Currently employed (78%) and retired (83%) individuals stated they had not seen a change in employment due to the COVID-19 crisis (Fig 3B). Fifty-six percent of consultants indicated a change in employment conditions, predominantly reduced hours, due to the pandemic. Twenty-five percent of students reported either being either laid off or furloughed since the start of the pandemic. Looking at change in employment by age (Fig. 3C), the youngest cohort (ages 18–30) reported the highest percentage of lay-offs (14%) followed by the 31- to 45-year-old group (11%). The 46- to 60-year-old group fared the best with only 6% losing their jobs while those aged over 60 had 7% lay-offs. However, experiencing reduced hours was more common for the older groups, in which almost 22% of respondents aged over 45 years had their hours reduced compared to 14% of the those up to age 45.

Change in employment status was most pronounced in the mineral exploration sector, with 11% of respondents in this sector having lost employment while 23% had suffered reduced hours



**Fig. 2.** iCrag COVID-19 Survey responses concerning impact of the pandemic. A. Whether the pandemic has affected the respondent. B. The effects of the pandemic on individual respondents. C. Level of concern about employment in the future due to the pandemic by respondents.



**Fig. 3.** iCrag COVID-19 Survey responses on the impact of the pandemic by group. A. Impact on employment status by geographic region. B. Impact on employment status by type of current employment. C. Impact on employment status by age. D. Impact on employment status by employment sector. E. Impact on employment status by commodity the survey participant was involved with.

and 6% reported having been furloughed (Fig. 3D). Both mining and minerals research were less affected; nevertheless, 24% of respondents from the mining sector and 18% of those in the minerals research sector reported negative employment changes. The government sector reported the least change in employment though even there 10% of respondents reported reduced hours due to the COVID-19 crisis. The impact of COVID-19 on employment in the base metals,

industrial metals, and precious metals sectors was broadly similar (Fig. 3E).

**Concern about job security due to COVID-19 in 2020**

Looking to the future, 26% of respondents were very concerned (scoring 4 or 5 on a 5-point scale) about future employment due to the pandemic, 43% stated they had little or no concern about future employment, while 22% were moderately concerned, and 9% had already lost their job (Fig. 2C). The

level of concern varied by geographic area among the respondents (Fig. 4A). Some 36% of African respondents were very concerned about job security going forward due to the pandemic. Respondents from South America were next in line with 33% stating strong concern. These areas also had the highest rate of job loss due to the pandemic. Approximately 50% of respondents from Asia and Australia had little to no concerns about employment in 2020 going forward. Even though Europe showed

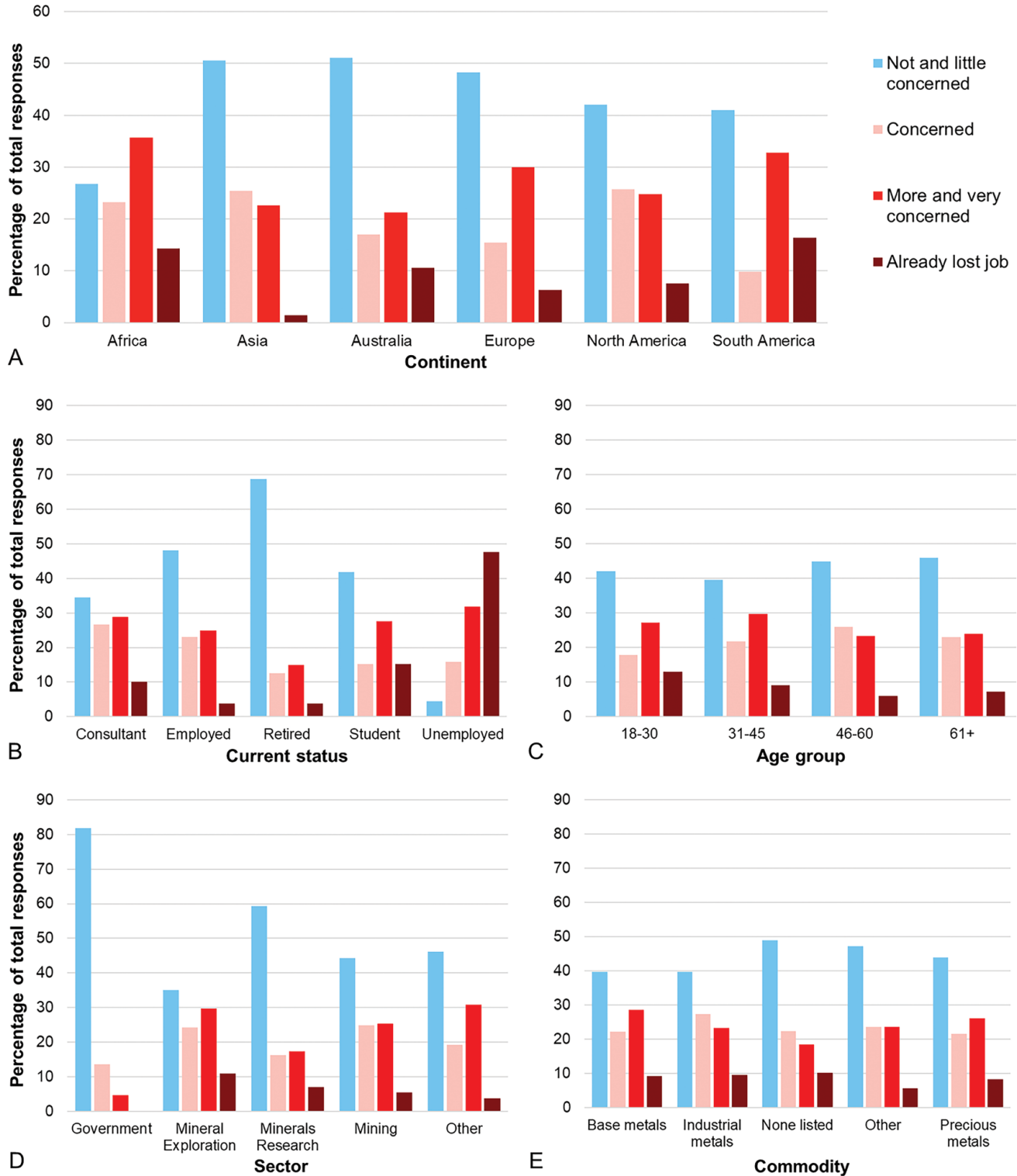
Impact of the COVID-19 Pandemic on the Minerals Sector: A Real Time Survey (continued)

the least change in employment due to the pandemic, 30% of its respondents recorded being very concerned about employment for the rest of 2020.

The survey results for job security concerns in 2020 by current employment status (Fig. 4B) showed the

unemployed (32%) being the most concerned, followed by consultants (29%), then students (28%), and those employed (25%); retired respondents were the least concerned. Concerns by age (Fig. 4C) indicate that those aged 31 to 45 were most concerned, with 30%

of the 31- to 45-year-old cohort being very concerned and a further 22% being concerned about job security in 2020. However, younger people were not far behind, with 27% of the 18- to 30-year-olds reporting that they were very concerned. Older people were somewhat



**Fig. 4.** iCrag COVID-19 Survey responses on concern about the impact of the pandemic. A. Concern about employment by geographic region. B. Concern about employment by type of current employment. C. Concern about employment by age. D. Concern about employment by employment sector. E. Concern about employment by commodity the survey participant was involved with.

less concerned about the impact of the pandemic on their employment for 2020, with 23% of 46- to 60-year-olds, and 24% of the group aged over-60 reporting strong concern.

Slightly over 50% of those in both the base metals and the industrial minerals sectors were somewhat to very concerned about job security (Fig. 4D). Those in the precious metals sector fared slightly better, with 48% showing concern or significant concern. By sector, those in mineral exploration were the most concerned about job security in 2020 followed by those in mining and in the “other” job sector category (Fig 4E). Not surprisingly, government employees had the least concern though even in this group approximately 18% expressed concern or strong concern.

## Discussion

This survey reflects the experiences of a self-selected section of people in the minerals industry at a particular point in time. We cannot ascertain how well the respondents represent the total workforce because there are no readily available data on the demographics of the global minerals sector workforce. There are some general indications that the survey results are credible. The age distribution matches well with the age distribution of employees in the U.S. “metal ore mining, nonmetallic mineral mining and quarrying, and not specified type of mining” employment categories for 2019, with 49% of all survey respondents being under 45 vs. 52% reported by the Bureau of Labor Statistics (2020a). The number of respondents from the United States who reported losing a job (6.6% of 303 survey responses) is very close to the reported loss of jobs in the U.S. mining (except oil and gas) workforce between January and April 2020 of 6.8% (U.S. Bureau of Labor Statistics, 2020b). Data from Australia indicate that expenditure on exploration on areas including existing deposits fell 16.0% and on areas of new deposits by 26.1%; base metals projects were impacted more than gold or iron ore projects (Australian Bureau of Statistics, 2020). Our survey results show that employment in the exploration sector was most affected but indicated less differentiation between the base and precious metals sectors.

The timing of the survey may have been fortuitous in capturing responses at the cusp between global awareness of the pandemic and the

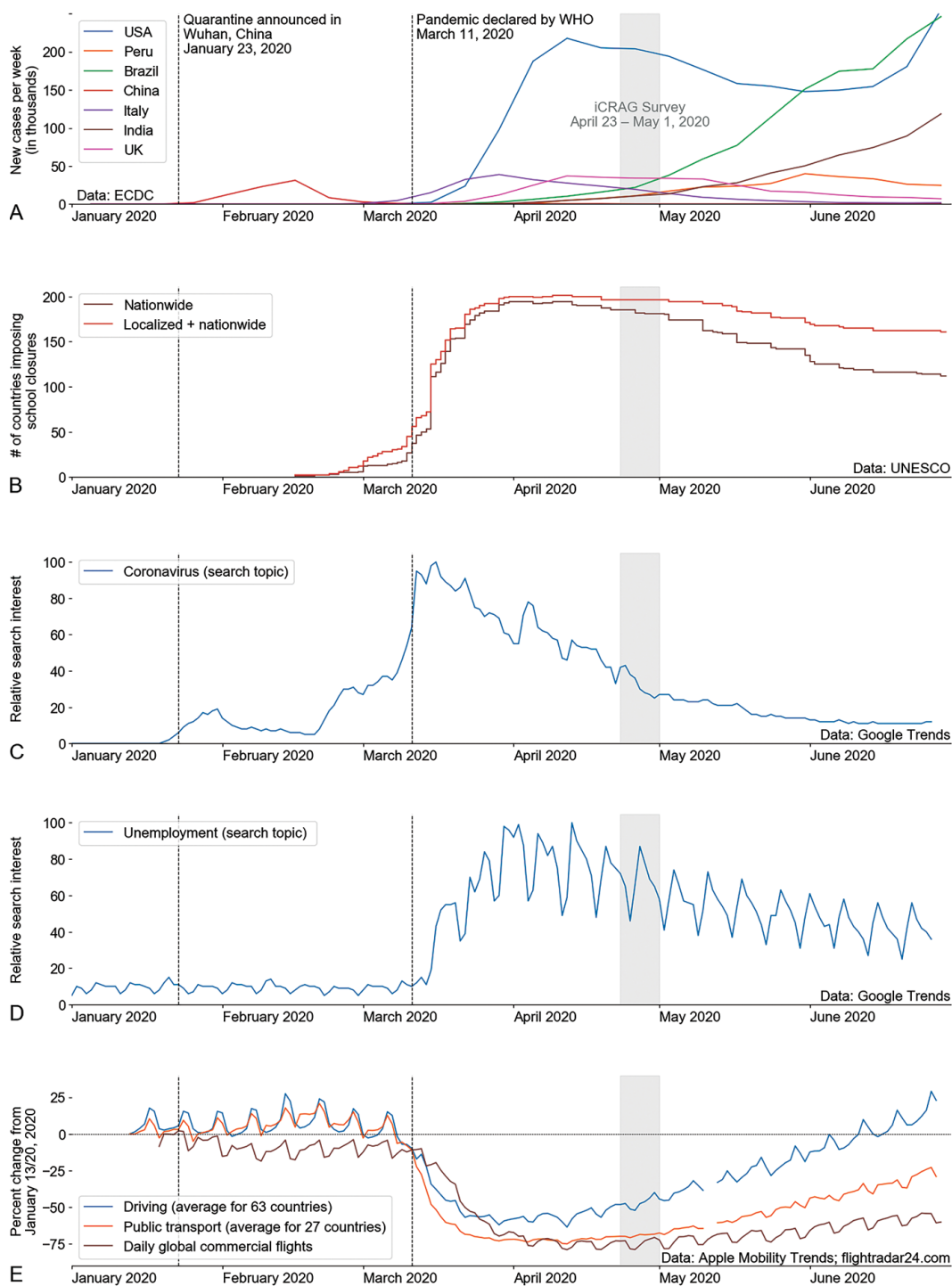
initial reopening of many economies. Although Wuhan entered quarantine on January 23, 2020, known cases outside of China did not rise significantly until March (Fig. 5A). The WHO announcement of the COVID-19 pandemic on March 11, 2020, was quickly followed by lockdowns worldwide as demonstrated by school closures (Fig. 5B). The survey at the end of April was conducted just after the first peak of COVID-19 cases in the United States, while weekly newly confirmed COVID-19 cases were still very high in Europe, but prior to a sharp rise in cases in Brazil and India (Fig. 5A).

Public interest in the pandemic, as represented by daily Google searches for the topic “Coronavirus” and related terms (Google LCC, 2020) peaked coincident with the WHO announcement and then began a slow decline throughout March and April (Fig. 5C). Daily Google searches for the topic “Unemployment” and related terms show a nearly tenfold increase in late March compared to the beginning of the year (Fig. 5D), likely reflecting global concern about job losses as a consequence of COVID-19 containment measures. Search interest in the topic “Unemployment” gradually decreased in April but, by the end of June, was still about five times higher than in the beginning of the year (Fig. 5D). The decreasing interest in both “Coronavirus” and “Unemployment” search topics corresponds to the gradual easing of COVID-19 containment measures around the world after the iCrag survey was conducted at the end of April. As government responses became less stringent globally (Hale et al., 2020), nationwide school closures became less common (Fig. 5B), and people began to travel more in May, as indicated by the daily number of routing queries for driving and public transport in the Apple Maps application (Fig. 5E; Apple Inc, 2020). The survey was also conducted just as mine closures were beginning to wind down and some mines that closed earlier in the pandemic were beginning to reopen (S&P Global Market Intelligence, 2020).

Company press releases are a key source of corporate information on the minerals sector and were examined to provide additional context for our survey results. Based on an analysis of 1,234 press releases from publicly traded junior resource companies collated by the Junior Mining Network (2020) between January and mid-June

2020, the overall number of press releases began to drop in mid-February 2020, perhaps reflecting a decrease in corporate activity. COVID-19 was first mentioned in these mining company press releases in mid-February in connection with delayed shipments of mine construction components from China. COVID-19 was mentioned frequently in press releases during April and May 2020. Some press releases provided information on mine closures or suspension of activities. Several press releases highlighted corporate efforts to mitigate the impact of the pandemic on workers and local communities, including improved health and safety measures, donations of personal protective equipment, water, and food, as well as providing education about COVID-19. However, it proved very difficult to derive a comprehensive picture of the impacts of the pandemic on the minerals sector from press releases, reflecting the selective nature of the information provided.

Perhaps the most surprising result from the survey is that while 65% of respondents felt that COVID-19 had significantly impacted their work, only about a third of the respondents reported a significant change in employment status. At the time of the survey the globe was largely in lockdown (Fig. 5B), people in most non-essential sectors were working from home, and some had been furloughed or laid off. The fact that nearly two-thirds of respondents did not report significant impact on their employment status illustrates how the mining and mineral exploration industry differs from many other industries and sectors of employment. This may reflect the fact that some countries considered mining to be an essential activity, meaning that mines remained in operation. Some companies quarantined workers at mine and exploration sites to enable them to keep working without contact outside the workplace. In mineral exploration it appears many were transferred from fieldwork to work on desk studies that did not entail travel, especially international air travel which was largely interrupted (Fig. 5E). Though details were not requested in the survey, the high percentage of students (25%) reporting either being laid off or furloughed since the start of the pandemic may represent loss of research project or internship funding and/or inability to complete research due to closure of

Impact of the COVID-19 Pandemic on the Minerals Sector: A Real Time Survey (*continued*)

**Fig. 5.** Comparison of time series relating to the COVID-19 pandemic from January to June 2020. Vertical lines indicate the announcement of the quarantine in Wuhan, China (23.01.2020), and declaration of the COVID-19 pandemic by the World Health Organization (11.03.2020); the shaded area highlights the time of the iCrag survey (23.04.–01.05.2020). A. Weekly number of newly confirmed COVID-19 cases for a selection of countries (European Centre for Disease Prevention and Control, 2020). B. Number of countries declaring country-wide or local school closures (UNESCO, 2020) as part of their COVID-19 containment measures. C. Google Trends data for daily relative global interest in the topic “Coronavirus” (Google LCC, 2020). The Google Trends data for topics include Google searches in different languages and for related terms. D. Google Trends data for daily relative global interest in the topic “Unemployment” (Google LCC, 2020). The periodicity of the data reflects variation between weekdays and weekends. E. Relative change in driving, public transport (Apple Mobility Trends, Apple Inc, 2020) and commercial flights (Flightradar24, 2020). The daily Apple Mobility Trends data show relative change from January 13, 2020, for routing queries in Apple Maps. Data for driving are the daily averages for 63 countries; data for public transport are the daily averages for 27 countries. Data for daily global commercial flights show relative change from January 20, 2020. The periodicity of the data reflects variation between weekdays and weekends.

labs or restrictions on fieldwork (Gonzales and Keane, 2020).

The survey demonstrates that while there were significant similarities in response to the pandemic by individuals in the mineral industry worldwide, differences can be discerned geographically. The pandemic was severe in Europe and North America at the end of April and there was widespread appreciation of its potential long-term effects, but many people were beginning to move (Fig. 5E) indicating a weakening of the lockdowns. The survey results reflect this with large majorities stating that the pandemic had affected their work to some degree and with widespread worry about the future in terms of employment. The very high levels of concern in Africa and South America are notable because at the time of the survey the pandemic had not led to the dramatic number of reported cases and deaths in these areas compared to those then observed in Europe and North America. However, according to our analysis of mining company press releases and data collected by S&P Global (2020), minerals sector operations in Latin America and South Africa were most affected by COVID-19 containment measures.

Most of the survey results are what would be expected in terms of response by age and by employment status with younger employees and consultants most affected. Results by type of employment were predictable with those in the mineral exploration sector both most affected and also most concerned, reflecting the typical response to a downturn in the minerals industry when exploration spending is commonly an early casualty followed by changes of employment for temporary or contract employees.

## Conclusion

The survey provides insights into the effects of COVID-19 on the minerals sector workforce

at a distinctive point in time during an unprecedented global event. It captures the experiences and perceptions of individual workers, providing a perspective that is different from the information in corporate statements and official statistics. Surveys such as this can supplement other approaches such as economic analyses and data-mining studies (e.g., Stephany et al., 2020) as we strive to understand the full implications of the COVID-19 pandemic.

## Acknowledgments

We wish to thank all those that took part in the survey as well as those who helped spread awareness of its existence.

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# COVID-19 and the Global Mining Industry

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## Abstract

The world is currently experiencing a rapid and deep economic slowdown as a result of COVID-19 mitigation efforts. The depth and global nature of this recession, which could turn into a depression, suggests that this pandemic will significantly affect the demand for metals and the global mining sector. The majority of governments consider mining to be essential, meaning that

the effect of mitigation on the mining industry and on metal production has been minimal to date. However, increases in metal stocks and decreases in metal prices suggest that the mining industry will be negatively affected by the COVID-19 crisis, at least in the short term.

This paper presents an overview of the effects of COVID-19 mitigation on the mining sector to date.

That includes variations in metal and commodity prices and stocks during the crisis and the outlining of two possible scenarios for COVID-19 related impacts. The first involves persistent supply-chain disruptions, where metal supply is restricted by logistical or COVID-19-related mitigation impacts on intermediates such as smelters and refiners. This restriction of supply could cause higher metal