Creating and Promoting Gender Equity and Diversity in Professional Geological Societies: A Focus on AAPG

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Abstract

When professional organizations allow gender inequity to persist, they continually lose talented, valuable individuals who enrich and lead their groups. According to membership data collected by the American Association of Petroleum Geologists (AAPG), the American Geophysical Union (AGU), and the Geological Society of America (GSA), there is evidence of continued gender inequity in professional geological societies, particularly in the AAPG. Within AAPG, there are significant gender inequities in the percentage of women and non-binary individuals holding leadership and technical positions, publishing articles, giving distinguished lectures, and receiving technical awards. Because the AAPG is a major international geoscience professional organization, this inequity greatly contributes to the gender disparity that exists in the greater geoscience community. The evaluation of historical AAPG membership data in this study allows for an opportunity to provide solutions to advance gender equity and give meaningful power by implementing diversity standards in AAPG's most visible and prestigious opportunities. By addressing this issue, professional societies such as AAPG can demonstrate tangible efforts to eliminate the discrimination, bias, and barriers many women and non-binary individuals encounter and support them in having equitable opportunities as professional geoscientists.

Introduction

Throughout society in the modern Anglophone West, significant gender disparities, bias and discrimination exist. This is realised in many facets of society, including in professional workplaces and organisations. Not all of these inequities can be presented with quantitative data, however some can, and these can provide a useful basis for consideration of gender equity matters. For example, only 7% of women are currently CEO of a Fortune 500 company (Hinchliffe, 2020; Figure 1), only 27% of women hold the title of President at universities (U.S. Department of Education, 2017; Figure 2), and only 17% of the people who continue in a long-term STEM (science, technology, engineering, and mathematics) career beyond their educational training are women (Australian Academy of Science, 2020). When considering the proportion of women specifically in the geosciences, they represent lower percentages than men in academic roles, a proportion that decreases with increasing level of position (Figure 2). The exception to this, based on a 2009 study, found that of the 14% of women in academic

roles, 21% hold department leadership roles (Figure 2; Patterson et al. 2016). The marginalization of diverse experiences and contributions made by women and non-binary people is unjust, and from a business and technical perspective reduces the innovation of thinking and knowledge-production needed to address complex problems, with broad-ranging detrimental impact (Marín-Spiotta et al., 2020).

Several authors (Gonzales, 2019; Newton, 2012, Popp et al., 2019) link gender inequality to a lack of visible role models and workforce retention issues. Low retention has been described as a "leaky pipeline" where many candidates who enter the profession in college are not able to retain or obtain a job in the geosciences later in their career (Holmes et al., 2008). However, it has recently been suggested that the "leaky pipeline" metaphor should be replaced because it does not capture the active and continual barriers that women and non-binary people in science face (e.g., Berhe et al., 2022). According to Berhe et al. (2022), "Inclusive and equitable geoscience requires identification and removal of structural barriers to participation. Replacing the leaky pipeline metaphor with that of a hostile obstacle course demands that those with power take the lead." Attrition occurs as women leave the workplace at higher rates than men throughout their careers due to that "hostile obstacle course" (Fouad et al., 2017; Cech and Blair-Loy, 2019, Berhe et al., 2022). Many studies have identified factors or reasons that contribute to women leaving geoscience, which includes, but is not limited to, 1) a lack of visible sponsors: limited mentors and advisors, 2) emotionally unsupportive classroom and work environments, 3) gender-based isolation and discrimination, 4) biased or nepotistic hiring and lay-off practices, 5) 'family-unfriendly' policies, 6) poor marketing of geoscience programs to minorities and women, 7) a difference in career goals and paths between men and women, and 8) low self-confidence and self-efficacy among women and minority geoscientists (Baber et al., 2018; Callahan et al., 2015; Ceci et al., 2011; Estrada et al., 2018; Holmes et al., 2008; Holmes and O'Connell, 2003; Stokes et al., 2015; Williams, 2012; Williams, 2017; Williams, 2021).

A variety of implemented strategies have been utilized with the aim of boosting representation of women in STEM. Introduction of mentoring schemes for women; substantial effort placed in developing and setting expectations around code of conduct; legislated targets for CEO's and Board membership for top companies; and increasingly common policy within companies and universities regarding recruitment processes. In the case of the latter, these processes can include extending recruitment windows/not shortlisting until a target quota of women applicants is received, creating separate shortlists for men and women, and an introducing policy to interview at least one man and one woman for any available position. In the last decade, there have been significant efforts to recruit greater numbers of women into STEM fields, spanning pre-K through graduate education. For example, programs such as the

Ad Council's "She can STEM," funded by Microsoft, Google, and IBM; the National Science Foundation (NSF) ADVANCE program funded by the United States Federal Government; and the Women in STEM Careers (WiSC) program funded by the Australian Federal Government have all contributed significant funding to promoting women in STEM (Williams, 2021).

Geoscience enrollment and degree trends indicate these efforts have been generally successful. From 2010-2017, data published by the American Geosciences Institute (AGI; Gonzales, 2019) shows that enrollment and graduation rates of women with B.S., M.S., and Ph.D. degrees in geological sciences have remained steady between roughly 35-45% compared to approximately 20-25% in 1985. Despite the increase in university enrollment in geoscience degrees by women, current data indicate significant inequity persists in the gender distribution of professionally employed geoscientists. While historically high percentages of women earn geoscience degrees, those percentages crumble to roughly half of women employed as professional geoscientists compared to their male counterparts (Gonzales, 2019). During the same period above (2010-2017), data from the National Science Foundation (NSF) and AGI indicate that the percentage of women with geoscience degrees working as geoscientists decreased from 17% to 11%.

These inequities are not only observed in the workforce but also in professional organizations. Visible women in prestigious geoscience leadership positions, awards, publications, distinguished lectures, and technical roles are underrepresented relative to men and relative to the total percentage of women scientists within geoscience professional society membership (Lincoln et al., 2012; Holmes et al., 2015; Fernandes et al., 2020). The geosciences are also the least racially diverse of the STEM disciplines (Dutt, 2019; Bernard and Cooperdock, 2018). Women of color are rarely nominated or selected for leadership positions and awards, falling into "the double bind" or "double jeopardy" phenomena (Malcom et al., 1976; Ceci et al., 2014). Additionally, women's movements frequently fail to adequately lift the perspectives and voices of First Nations' women and women of color by ignoring the specificity of their cultural and social experiences (O'Sullivan, 2019; Crenshaw, 2018; Suzack et al., 2010; Block, 2012). Recent data indicate that the ongoing impact of implicit and explicit bias on women's careers is real and significant (Eaton et al., 2020; Huang et al., 2020) and is even more detrimental for women of color (Dutt, 2016). That implicit and explicit bias over the length of a woman's career severely limits the candidate pool's diversity for prestigious leadership positions, technical and service awards, publications, distinguished lectures, and technical roles within geologic societies, further causing gender inequality. Systemic inequities leave women regularly "swimming upstream" or "working against a headwind," which leads to less wealth, increased burnout, and systemic mental and physical health issues (Hagni, 1984; Kotok, 2007).

The lack of diversity and inclusion is not only related to ethnic and cultural background, but also disability, neurodiversity, sexual orientation, and gender-diversity (Ali et al., 2021). When focusing on gender-diversity, it is important to ensure that all relevant barriers are considered, such that proposed solutions benefit all, not only cis-gender, heterosexual white women, for example. Whilst focusing on gender, it is important to note that it is well understood that gender is not binary (Spizzirri et al, 2021). Cisgender describes people whose personal identity and gender correspond with their sex (physical characteristics: male, female, intersex) assigned at birth. Transgender describes people who identify with a gender that is different to the one assigned to them at birth. Non-binary refers to people whose gender is outside those of man and woman (Matsuno & Budge, 2017). Many different gender identities have been defined, and boundaries between the categories can overlap (Spizzirri et al, 2021). The estimated proportion of people who are not cisgender (e.g., they are gender-diverse) ranges between 0.1 – 2% (Spizzirri et al, 2021). This should be considered when interpreting gender data for which only binary options were available. Additionally, it is important to understand that where non-binary gender options are included in questionnaires, people who have been treated with disrespect, abuse, and discrimination because of their sex or gender may be unwilling to reveal this information to their government, workplace, or professional organizations (Australian Bureau of Statistics, 2018; Jones et al., 2021).

Professional organizations thus have an important role to play in driving change, alongside those efforts made by workplaces and legislated for by governments. For example, AGU not only published a press release of their diversity efforts (Lerback and Hanson, 2017), they released a Diversity and Inclusion (D&I) Strategic Plan that recognizes the critical need of a D&I plan for the organization to be successful (American Geophysical Union, 2018). Furthermore, not only does The Geological Society of America publish regular D&I reports (Huntington et al., 2021), initiatives, and recommended reading resources, the GSA adopted a Diversity in the Geosciences position statement in 2010 and continually worked to update it in 2013, 2016, 2021 (White, 2021). Because major geoscience professional organizations have recently completed studies examining the internal gender balance of key roles (e.g., Fernandes et al., 2020; Handley et al., 2020), we propose that it is appropriate and important to undertake such a review for AAPG. In doing so, we note the importance of qualitative and autoethnographic studies on this topic, connecting personal experiences with social and political context (e.g., Williams, 2021); quantitative studies can be useful, but are not comprehensive.

A presentation at the AAPG ICE London in 2017 (Jackson, 2017) drew attention to a lack of gender and ethnic diversity in AAPG Distinguished Lecture and technical awardees, highlighting that only 3% of AAPG Association Awards in 72 years have been awarded to

women, and 5-13% of Distinguished Lecturers are estimated to be women (uncertainty due to estimation of gender based on name data available). Jackson (2017) noted that no data were available to analyze representation of other historically under-represented groups, which is still the case in 2022. Because the energy industry is a significant employer of professional geoscientists, many geoscience professionals globally rely on the AAPG for networking, training, and professional opportunities. Since AAPG plays a major role in the geoscience workforce landscape, examining metrics of gender equity within AAPG is critical to continued efforts to diversify the workforce.

In the context of the above background, the goals of this study are to 1) utilize available data from AAPG to evaluate the gender distribution of members, those who are in leadership or technical roles, won technical or service awards, published papers in society journals, or held distinguished lecturer positions within AAPG; 2) compare data to that available from other geoscience professional organizations including the GSA and AGU; and 3) provide recommendations for future initiatives based on the results of the data analysis, documented literature, review of other societies' D&I strategies, and the experiences of the authors through their involvement with this esteemed professional society.

AAPG Structure, Bylaws, and Code of Conduct

AAPG was founded in 1917 to foster scientific research, to advance the science of geology, to promote technology, and to inspire high professional conduct (Code of Conduct). They accomplish these goals by providing publications, conferences, and educational opportunities to geoscientists. AAPG is a nonprofit corporation recognized by the IRS as an Internal Revenue Code section 501(c)(6) organization. Historically, AAPG has focused on the science of petroleum geology and recently has been including carbon storage, hydrogen storage, geothermal, and mineral exploration. AAPG's highest membership numbers slightly exceeded 40,000 geologists, geophysicists, CEOs, managers, consultants, students, and professors in 129 countries in 1987, 2013, and in 2014. As of 2017, AAPG's membership number dropped off to 30,000 individuals. Membership numbers mimic the economic cyclicity in the petroleum market. Of AAPG membership, 45% holds a title of manager or above, 8,000 are students, and 39% live outside the United States. For 43% of the membership, exploration is the primary concentration and the primary concentration of 18% is on development/reservoir management. AAPG has nearly 100 Affiliated Societies worldwide and 11 national or international organizations which hold Associated status with AAPG.

The AAPG Executive Committee (EC) exercises executive control and management of the affairs and funds of the AAPG. It serves as the Association's Board of Directors and consists of the following members: 1) President (one year of service), 2) Vice President, Sections (two

years of service), 3) Vice President, Regions (two years of service), 4) President-Elect (one year of service), 5) Secretary (two years of service), 6) Treasurer (two years of service), 7) Editor (three years of service), and 8) Chair, House of Delegates (one year of service). All positions, except the Chair of the House of Delegates, are elected by the voting members of the Association, which does not include students. The Chair of the House of Delegates is elected by the members of the House, which voting members elect. A voting member is one whose dues are paid in-full and who have fulfilled the requirements for Member. According to AAPG's Bylaws, the president is the chief executive officer and spokesperson for the Association on all matters pertaining to the public; serves as chair of the executive committee, appoints the members of all committees in accordance with these bylaws; and appoints delegates to cooperating organizations to represent the Association. The president-elect serves as a member of the executive committee, presents a budget for the ensuing year to the executive committee, and succeeds to the office of president following their term as president-elect. The vice president-sections with their other duties, concerns themself with the activities of the Association in respect to United States sections. The vice president-regions with their other duties, concerns themself with the activities of the Association in respect to its regions. The secretary is responsible for recording the actions of the executive committee; keeping possession of the corporate seal and affixing the same; and, subject to executive committee approval, has policy oversight of all non-technical and non-peer reviewed publications and communications. The secretary performs other duties as may be directed by the executive committee. The treasurer supervises the receipt of all funds and, under the direction of the executive committee, is responsible for all disbursements of funds of the Association; serves as an ex-officio member of the committee on investments; gives bond, the amount of which shall be determined by the executive committee; makes the annual report as treasurer; and performs such other duties as directed by the executive committee. The editor has general supervision of and final authority in soliciting, accepting, and rejecting all material on technical subjects for publication; has policy oversight and responsibility for editorial content of all technical and peer-reviewed publications; submits an annual report of editorial activities to the executive committee; and, with the approval of the executive committee, appoints volunteer editors as deemed necessary.

The Advisory Council acts in an advisory function for the Association. Its membership is comprised of 1) the Immediate Past-President, 2) Two previous Past-Presidents, 3) the Immediate Past Chair of the House of Delegates, 4) the Chief elected officer of each Division, 5) Section councilors, and 6) Region councilors. The Advisory Council has no executive authority and reports to the Executive Committee on all matters involving ethics and discipline referred to it. Primarily, the Council conducts long-range planning and reports to the EC on all matters involving review of the constitution and bylaws. It recommends the EC nominations

for Association officers and most honors and awards. It also reviews the overall organization of AAPG and its committee structure while undertaking any special projects assigned by the EC.

The legislative function of the AAPG falls under the responsibility of the House of Delegates (HoD). It is made up of elected delegates as defined by the Association bylaws. Delegates are elected by popular vote and serve three-year terms. The HoD meets annually during the AAPG Annual Convention and Exhibition, which is when they elect their officers for the next fiscal year. Officers are the Chair, Chair-Elect and Secretary/Editor. Each is a one-year term that starts on July 1.

The AAPG Sections are made up of individuals and affiliated geological societies. They combine their efforts to organize technical meetings and generate content for publications and newsletters. Currently there are six US-based Sections (Eastern, Gulf Coast, Mid-Continent, Pacific, Rocky Mountain, and Southwest) and each elects Councilors to serve on the Advisory Council for three-year terms. If the Section has more than 750 members, their councilors may vote on the Advisory Council. The AAPG Regions are made up of individuals and affiliated geological societies. They combine their efforts to organize technical meetings, generate content for publications and newsletters. Currently there are six Regions (Africa, Asia/Pacific, Canada, Europe, Latin America and Caribbean, and Middle East) and each elects Councilors to serve on the Advisory Council for three-year terms. If the Region has more than 750 members, their councilor may vote on the Advisory Council.

The Honors and Awards program of AAPG provides a means for recognizing outstanding achievements and contributions by professional geologists, especially in the areas of exploration for petroleum and energy mineral resources, and by other professionals who further the goals and objectives of geological science, the geology profession, and the AAPG. The selection process for AAPG's Honors and Awards begins after the nomination deadline, which falls on January 31annually. Awards are then presented at the annual meeting the following year. The AAPG Honors and Awards (H&A) Committee, a committee within the Advisory Council, is responsible for communication and coordination of the H&A program. The H&A Co-Chairs operate the H&A portion of the AC meeting in executive session following Robert's Rules of Order. The entire Advisory Council discusses and votes on all the qualifying submissions. The H&A Co-Chairs forward the results to the Executive Committee for their consideration and approval. The awards are an extremely significant aspect of AAPG because it allows the Association to express its gratitude to its members and recognize the values and standards that are encouraged to the membership.

Methods

The gender distribution data utilized in this study were compiled from annual reports provided to the authors by the AAPG, GSA, and AGU. The authors assigned AAPG gender data based on historical member knowledge and memory of the gender of the individuals. The authors engaged with several key AAPG leadership personnel whose experience spans 1980-present, in order to best assign gender to names in the data provided. If the gender was not able to be determined, the authors assign "unknown" against gender.

To date, there has not been an opportunity for AAPG members to express non-binary or trans gender and therefore this analysis is incomplete, but a best attempt of goodwill. The authors recognize that researchers and committees may be discouraged from undertaking this type of study because it is too hard or professionally limiting (Jones et al., 2019; Ryan and Hermann-Wilmarth, 2019) or deviate from methods that include non-binary or transgender individuals (Allen et al., 2014). Researchers have also raised the challenges of managing ethics review boards 'concerns for participants' wellbeing (Allen et al., 2014; Donelson and Rogers, 2004), representing the research focus in uncontroversial ways (Donelson and Rogers, 2004) and masking their research with normative language (Rawlings, 2018). This study acknowledges the presence of institutional transphobia, "the institutional discourses and logics that reflect and embed heteronormativity and cis-normativity" (cf. Maughan et al., 2022); a result of institutional and wider social context, and something that can be implicit or explicit, obvious, or difficult to identify. The gender data we present are thus inherently flawed, but a best attempt possible; the authors request of readers that these above-mentioned considerations are incorporated in any interpretations or use of data presented herein.

Data Analysis

Executive Committee Leadership

Since 1917 there have been 1,138 EC leadership positions within AAPG and its divisions (Division of Professional Affairs-DPA; Division of Environmental Geoscientists-DEG; Energy & Minerals Division-EMD; Petroleum Structure and Geomechanics Division-PSGD not included). The first woman was elected to a leadership position in 1987; since then, 145 women (13%) have held leadership positions (Fig. 3, 4, 5). Since 1987, women have held leadership positions every year except for 1994. Since 1987, the percentage of women in AAPG leadership is higher than the percentage of AAPG women members for 31/34 years. The ratio of women to men ranges from 1.8% to 21% (average 5.5%). The percentage of women in leadership has been increasing; 2020 marks the largest number of women in leadership - women held 10 (46%) of the 22 positions. Robbie Gries (2001-02), Randi Martinsen (2014-15), Denise Cox (2018-19), and Gretchen Gillis (2021-2022) are the only women to serve as AAPG President. Martha Lou Broussard (1987-88), Brenda Cunningham (1990-91), Valary Schulz (2004-05), and Kristie Ferguson (2021-2022) have been the only women to serve as Chair of the House of Delegates.

Over the last ten years (2011-2020), Secretary and Editor are the positions most often held by women. The Secretary is the only position where women have held office more than men.

Awards

Since 1917, there have been 3,932 awards granted by AAPG, including the AAPG Foundation. Men have received a total of 3,348 (85%) awards and 497 (13%) were received by women (Fig. 6 & 7). For 87 awardees, their gender is unknown: largely due to gender neutral names. To produce the highest possible number of women awardees, if all the unknown gender awardees are women, the proportion of awards to women increases to 15%. Almost half (49%) of all awards that have recognized women were awarded in the last decade.

The first award granted to a woman was in 1963 (Dollie Radler Hall; Honorary Member). Since 1975, at least one award has been presented to a woman every year. In 2017, 30 (22%) women received awards, the largest number of women recognized in a single year (compared to overall women membership of 19%). Over the last ten years (2011-2020), the ratio of men to women award recipients ranged from 3.2 to 7.1 (4.6 average). The Young Professionals Exemplary Service Award is the only award with equal gender representation since its inception in 2017 (Fig. 6 & 7). As of 2020, a woman has never received AAPG's highest honor, the Sidney Powers Memorial Award. The percentage of women recognized by AAPG awards has been higher than the percentage of women members of AAPG for only three of the last ten years. This statistic is significantly higher than the percentage of women in leadership positions, which has been greater than the percentage of women AAPG members every year of the last decade.

Special Publication Editors, Distinguished Lecturers, Technical Roles

The previous and current editorial teams for AAPG's publications also lack diversity and equity. Editorial teams for the AAPG Bulletin (including Environmental Geoscience) include 40 men (72%) and 19 women (28%). Interpretation (collaboration with the Society of Exploration Geophysicists) includes 30 men (86%) and five women (14%). Since 1961, there have been 690 Distinguished Lecturers with just 48 (7%) women. The first woman Distinguished Lecturer served in 1982 (Doris Malkin Curtis). Over the two decades, the percentage of women Distinguished Lecturers has leveled off, but is highly variable within a given year, with the lowest representation being 6% in 2007 (Figure 8a).

AAPG lists instructors available for lectures and short courses on the organization's website, which therefore represents the most visible venue to examine the instructor pool's diversity. Of the 130 instructors listed, only 12 (9%) are women. Additionally, members who have volunteered to give short presentations to colleges and universities, known as Visiting

Geoscientists, are also available on the AAPG website. Of the 152 Visiting Geoscientists, 27 (18%) are women. Both percentages are lower than the current ratio of women AAPG members (21%).

Comparing AAPG data to that from the AGU & GSA

AAPG's percentage of women membership to women awardees is compared with GSA and AGU (Fig. 9). AAPG membership data indicate that membership of women has hovered between 19-21% since 2014, and prior to that (1917-2014), women membership was significantly less (<18%). Based on the results of this analysis, both GSA and AGU have more women members than AAPG. GSA is recognizing more women members than AGU and AAPG, but AGU is recognizing its women members less than AAPG.

Summary of Results

In summary, this study of AAPG data highlight the following key observations:

1) In 2020, women composed 21% of AAPG's membership.
2) The first woman was elected to an executive committee position within AAPG was 1987.
3) Since it was founded in 1917, women have held only 5.5% of leadership roles in AAPG. That number increased to13% in 1987.
4) Only 4% of ACE Chairs have been women. No woman has ever been an ICE Chair.
5) The largest number of leadership roles women have held in AAPG have been as Secretary or Editor.
6) Of all AAPG awards granted annually, only 13-15% went to women – half of those coming within the past 10 years (2010-2020).
7) The awards granted to women were primarily focused on service and dedication to AAPG and teaching rather than technical or research achievements.
8) As of 2020, no woman has ever received AAPG's most distinguished award, the Sidney Powers Award.
9) Women serving as Special Bulletin Editors is highly variable year to year at 28%.
10) Prior to 2000, only 7% of AAPG's Distinguished Lecturers were women. That number has climbed to 20% in the last two decades.
11) Only 9% of Visiting Instructors and 18% of Visiting Geoscientists were women.
12) There have been no openly transgender or non-binary people in positions of leadership or honour in the history of the society.
13) Women comprise 21% of the members of AAPG (2020), 32% of AGU, and 34% of GSA.

14) Award status of women in AAPG is like that in AGU, both of which are trailing behind GSA, which has the highest proportion of women award winners, notably higher than the proportion of women members in several recent years.

The data in this study specifically highlights and identifies key parts of AAPG that need to improve to begin to reach gender equality. For AAPG to begin to address the bias and discrimination toward women and gender non-binary members, it is key that the broad membership of the association acknowledge that these disparities exist in the first place. This data analysis provides the numerical justification for that bias and discrimination.

Discussion

The membership of women in AAPG trails behind other large geoscience organizations, like GSA and AGU, in D&I efforts, programs, and frameworks (Fig. 9a-c). Whilst the proportion of women in leadership roles and acknowledgments started to increase in the 1980's, the pace of change has been slow, with most of the uplift taking place only in the past 10 years. The disparity in the gender of AAPG award recipients in recent years (Fig. 9a) is striking, particularly when compared against similar data from AGU and GSA (Fig. 9b, c). AAPG women membership totals are lower than that of GSA and AGU and their awardees are consistently inequitable in comparison to the percentage of their AAPG membership (Figure 9a). Of these three organizations, the proportion of women award winners is highest in GSA. A key differentiating factor between AAPG and GSA/AGU is that the two latter organizations have made significant strides, especially the GSA, to incorporate a D&I policy as a part of their strategic plan, as mentioned above. AGU and GSA have recognized this issue and have created a plan to address it; AAPG has not yet undertaken this work. This is a clear indication of a culture within AAPG that is not yet "caught up" with broader society and other professional organizations in terms of gender diversity and inclusion. Thus, AAPG is failing both its membership and the broader geoscience community by contributing to the perpetuation of gender inequity and the loss of talent - the "hostile obstacle course" (Berhe et al., 2022) of the STEM disciplines and energy sector.

Another important observation is the high service tax on women as illustrated in AAPG's data by the disproportionately high representation of women in Secretarial and Editorial positions of leadership as well as in Distinguished Service and Teaching Service Awards (Figure 4, 7). This "tax" throughout their career ultimately impedes attaining higher level awards, like the Sidney Powers Award for example. It is common that women are pigeonholed in service, support, and teaching roles instead of leadership and technical positions, which ultimately hinders them from being competitive for even more prestigious technical roles, awards, and submitting first-author papers for publication (Witze, 2016;

Lerback & Hanson, 2017; Pico et al., 2020). Because women spend more time in such roles, this can be a contributing factor as to why so many never make it to the highest leadership levels among professional societies, academic institutions, or C-Suite industry positions.

Recommendations: Call to Action

The authors recommend that AAPG establishes a Position Statement that is committed to promoting a diverse scientific body and diversity of scientific ideas and the connections among them. For example, a suitable position statement that has been adapted from the Geological Society of America (White, 2021):

"The American Association of Petroleum Geologists (AAPG) is committed to promoting a diverse scientific body and diversity of scientific ideas and the connections among them.

This position statement (1) summarizes the consensus view of AAPG regarding the Society's commitment to diversity among AAPG membership and to Earth literacy for all people; (2) provides information that is intended to raise awareness among geoscience professionals implementing those policies and evaluating the short-and long-term consequences; and (3) encourages geoscientists to participate in implementing suitable diversity practices at local, regional, state, and national levels."

The authors recommend that AAPG collect member demographic data (within the confines of local privacy laws) to establish metrics to benchmark D&I efforts and programs. To facilitate future D&I efforts, AAPG needs to collect anonymous data that includes the option to select non-binary gender, race, ethnicity, and disability. The results need to be published yearly to ensure transparency and appropriate solutions (and within the confines of state and federal confidentiality laws). At a minimum and all levels of the organization, AAPG needs to become gender, racial, and ethnically balanced with respect to AAPG's overall membership statistics. AAPG's Code of Ethics provides a framework for appropriate and unprofessional behavior, however this Code of Ethics lacks D&I standards. The authors recommend that AAPG establishes a D&I Strategy that has been adapted from the Geological Society of America Diversity Working Group (Huntington et al., 2021):

"Achieving this vision requires an intentional approach that engages all AAPG Leaders, Members, and Staff in transforming AAPG's culture and practices. To enhance AAPG's existing efforts and accelerate this transformation, AAPG will:

1. Focus on data collection, measurement, and reporting. AAPG will take a deliberate approach to increasing justice, equity, diversity, and inclusion that prioritizes evidence-based

strategies, transparency, and accountability. AAPG will track the implementation of actions in priority areas, measure the impact on AAPG Members and functions, and effectively communicate progress and adjustments in approach.

2. Increase diversity and inclusion at all levels. AAPG will improve and develop processes that enhance diversity and equity throughout the Society, especially in positions of power and Leadership, decision-making, and standard setting, including AAPG Fellows and awardees, and in new Member recruitment. To attract and retain Members, AAPG must bring value to a broader audience and foster a culture of inclusion and sense of belonging for all.

3. Focus on structural change. AAPG will weave justice, equity, diversity, and inclusion into the operations, policies, and norms associated with all AAPG governance, services, programs, activities, and events. This integrated approach will elevate the importance of this work and, coupled with the measurement and reporting focus described above, will enable ongoing monitoring to facilitate continuous learning and help ensure sustained, impactful change.

4. Engage, empower, and hold responsible the AAPG community. AAPG must engage Members and Staff at all levels with empathy to foster individual ownership of this challenge and understanding of its value. AAPG will provide practical guidance and engagement opportunities, empowering Members and Staff to contribute to systemic and cultural change that foster a sense of belonging in AAPG for all identity groups, including both marginalized groups and those associated with relative positions of power or privilege. Responsibility for this work must be shared without overburdening minoritized people."

In addition to establishing D&I policies, women and non-binary members need to be nominated for AAPG awards and positions by their peers in significantly higher numbers. To address this issue, the authors suggest that there needs to be a diverse pool of candidates to choose from (many workplaces and organisations now have hurdle mechanisms in place to ensure this for award and recruitment) and the Honors and Awards Committee also needs to consist of a diverse population. The AAPG Women's Network has established a committee to compile women's nominations, resumes, AAPG activity, and service records in an evergreen database so applications can be tracked and easily submitted for award and position nominations. The AAPG Women's Network then makes their recommendations to the Advisory Council Honor and Awards Committee which is responsible for determining award recipients. Ideally this work would be undertaken by the Honors and Awards Committee, and not the Women's Network. The procedures that AAPG uses to determine the recipients of

AAPG awards and positions need to be transparent and publicly available to ensure policies and procedures are being honored and enforced.

Although AAPG has started to make small strides toward gender equity in recent years (especially since 2019), there are still significant inequities that need and must be addressed. A cultural transformation is greatly needed within the organization to support gender equity and thus increase participation and membership across all levels. AAPG must include historically under-represented members and students within conversations, leadership positions, award nominations, and give them the right to vote as they will be the next generation of leaders. We can tackle increasing membership of historically under-represented groups by actively seeking out students and professionals from these groups to be included in decision-making conversations and highlighting their achievements. Within minority groups, including women, we lose first-generation students because of a lack of quality mentoring and sponsorship and significant financial barriers. AAPG needs to include historically under-represented groups in all levels of its activities and consider appropriate practices for recruiting and retaining a diverse population. Support for all women does not translate to the same outcomes for marginalised women such as women of colour and First Nations women (as discussed by O'Sullivan et al (2019) and references cited therein); it is thus also imperative to address gender equity issues with respect to race and ethnicity. For this, the authors highly recommend referring to Ali et al. (2021) "An actionable anti-racist plan for geoscience organizations."

Conclusions

For AAPG and other professional geological societies to be successful and technically innovative in the future, they need to embrace and uplift historically under-represented populations (and all other marginalized members) by becoming more diverse and inclusive. We provided a base framework of demographic data for AAPG, as needed to analyze gender equity and diversity across all professional societies and organizations. Specifically, race and non-binary gender data need to be collected and published publicly for members of AAPG to view and make recommendations for improving the diversity and inclusion policy. We provide evidence highlighting how and why diversity and inclusion is important and highly encourage a cultural shift to take place within the greater AAPG organization. We recommend that the AAPG increases women's roles at all organization levels (from Session Chairs and Distinguished Lecturers to Leadership). By supporting the Women's Network and STEMulating Diversity SIG initiatives, it will allow diversity and inclusion practices to have greater influence over the AAPG community; however, it is also not the sole responsibility of those networks. Each member, leader, and staff member of the AAPG needs to be informed about the gender, racial, and ethnic inequities and embrace the AAPG community by improving the statistics and improving the overall experience of AAPG communications and activities. We hope that the

AAPG will embrace the Women's Network and STEMulating Diversity SIGs to provide structure and support to the rest of the organization and implement the processes required for a culture shift. Women, non-binary, transgender, and all other minority peoples need to be recognized and genuinely included through a shift in the balance of power at all levels of the organization. A good starting point, that can be tracked and reported against, is for them to be nominated for and appointed into many more technical and leadership roles and awards. Our hope is that through time, once gender equity is reached, the organization will have evolved so that the Women's Network and the STEMulating Diversity SIGs are no longer needed for such efforts.

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