

Creating and promoting gender equity and diversity in professional geological societies: a focus on AAPG

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Article history: received December 11, 2022; accepted February 22, 2023; published March 20, 2023

Abstract

When professional organizations allow gender inequity to persist, they continually lose talented, valuable individuals who enrich and lead their groups and drive innovation. This paper presents an analysis of membership data and ways in which member contributions are recognized by the American Association of Petroleum Geologists (AAPG) between 2017-2020, in relation to gender. These are compared to similar data from the American Geophysical Union (AGU), and the Geological Society of America

(GSA). All three of these societies (AAPG, AGU and GSA), whilst based in the USA, have substantial international membership. There is clear evidence of continued gender inequity in these professional geological societies, particularly in the AAPG; details are presented herein. Within the AAPG, there have been notable improvements in reducing the extent of gender inequities over the last decade. However, substantial gender inequities remain in the percentage of women and gender-diverse individuals holding leadership and technical positions, giving distinguished lectures, and receiving technical awards. The AAPG trails behind the GSA and AGU across the membership of women and diversity and inclusion efforts, programs, and frameworks. Because the AAPG is a major international geoscience professional organization, this inequity greatly contributes to the gender disparity that exists in the broader geoscience community. The evaluation of historical AAPG membership data in this study, alongside the review of published literature and actions to improve equity diversity and inclusion in other professional societies, allows for an opportunity to propose a range of improvements for AAPG to implement. We propose that implementing diversity standards in AAPG's most visible and prestigious awards will advance gender equity and give meaningful recognition and power to those present with a reduced opportunity to influence. We note and include reference to literature on this topic, that gender equity issues must be addressed concerning race and ethnicity. Specific actions should be taken to provide support for marginalized women such as women of color and Indigenous women, and gender-diverse people. As geoscientists, it is our moral and ethical obligation to address these issues so professional societies such as AAPG can demonstrate tangible efforts to eliminate the discrimination, bias, and barriers many women and gender-diverse individuals encounter and support them in having equitable opportunities and recognition as professional geoscientists.

Keywords: Non-Profit Professional Geological Societies; Gender; Diversity; Intersectionality; Geoethics.



1. Introduction

Indicators of gender inequality show dramatic improvement over the past ~40 years in the United States [England et al., 2020]. However, throughout society in the modern Anglophone West, significant gender disparities, bias, and discrimination persist, especially at the intersection of race and gender, referred to as intersectionality [Crenshaw, 1989; 2008]. Recent studies show a slowing or stalling of progress in the past 5 years [England et al., 2020]. This is observed in many facets of society, including in professional workplaces and organizations. Not all these inequities can be documented with quantitative data, however, some can, and these provide a useful basis for consideration of gender equity matters. The marginalization of diverse experiences and contributions made by women, gender-diverse people, and people of color is unjust and unethical [Mogk, 2021]. From a business and academic standpoint, ignoring diverse experiences and contributions reduces the innovation of thinking and knowledge-production needed to address complex problems, with broad-ranging detrimental impact [Page, 2007; Medin and Lee, 2012; Freeman and Huang, 2014; Phillips, 2014; Page, 2017; Marín-Spiotta et al., 2020]. Underrepresented groups produce higher rates of scientific novelty, but their contributions are devalued, discounted, or ignored altogether [Mukasa, 2009; Hofstra et al., 2020].

Despite the increase in university enrollment in geoscience degrees by women in the US, from 20-25% in 1985 to 35-45% between 2010-2017 [Gonzales, 2019], significant inequity persists in the gender distribution of professionally employed geoscientists. Although women account for 47% of the United States workforce, only 28% of geoscientists and environmental scientists are women, and the percentage of women with geoscience degrees working as geoscientists decreased from 17% to 11% between 2010-2017 (data from the National Science Foundation and AGI). In US Universities, women in geoscience hold only 15% of full professor positions, despite earning 43% of doctoral degrees (GSA, no date). Similar proportions of women are found in US federal government (44% of the workforce, with only 7.8% of STEM roles and 5% of senior executive positions occupied by women)¹ and in the oil and gas sector (women comprising 22% of the

¹ <https://www.opm.gov/policy-data-oversight/diversity-equity-inclusion-and-accessibility/women-in-the-federal-workforce-infographics.pdf>, accessed 20 February 2023.

workforce in companies employing over 1000 people, and 15% in smaller companies; PESA, 2018). Such low proportions of women in STEM careers and geoscience academic positions are not limited to the US; similar have been described for the Australasian region [Australian Academy of Sciences, 2020; Handley et al., 2020]. Furthermore, women of color represent less than 5% of geoscience degrees and less than 1% of all geoscience faculty positions at US universities, despite women of color comprising 18% of the United States population (GSA, no date). As stated by the Geological Society of America (GSA, no date) “The geoscience profession, and society at large, cannot afford to lose this human capital if we are to remain at the forefront of discovery and innovation critical to understanding Earth and its interactions with human society.” As members of these esteemed societies, it is our moral and ethical obligation to draw attention to these statistics and offer tangible, realistic solutions to elevate suppressed and overlooked individuals in our profession.

A variety of strategies have been implemented to boost the representation of women in STEM. These include the introduction of mentoring schemes for women; substantial effort placed in developing and setting expectations around codes of conduct; cultivating relationships throughout the career trajectory of potential candidates; ensuring that inclusive language is used in all advertisements and communications; defining job positions broadly so that potential candidates can see themselves as being qualified for a position; broadly advertising through many diverse channels and other media; and legislated targets for CEOs and Board members for top companies, an increasingly common policy within companies and universities regarding recruitment processes [Mogk, 2022]. In the case of the latter, these processes can include extending recruitment windows or not shortlisting until a target quota of women applicants is received, creating separate shortlists for men and women, and introducing policies to interview at least one man and one woman for any available position [Mogk, 2022]. 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]. Even with all this extra support and funding, the percentage of women working in STEM jobs rose from 11% in 2009 to 15% in 2021 [Australian Bureau of Statistics, 2021].

Rachelle Kernen et al.

Even though there are many sources of support, low retention has been described as a “leaky pipeline” or “braided stream” where many women who enter the geosciences in college are not able to retain or obtain a job in the geosciences later in their career [Holmes et al., 2008; Durham et al., 2022]. However, it has recently been suggested a “hostile obstacle course” metaphor more accurately captures the active and continual barriers that women, but especially women of color, Indigenous, and gender-diverse people in science face [Berhe et al., 2022]. The geosciences are the least racially diverse of the STEM disciplines [Dutt, 2019; Bernard and Cooperdock, 2018], and thus women of color face a “double bind” because of both sexism and racism [Malcom et al., 1976; Ceci et al., 2009; 2014]. It is important to be aware that the lack of diversity and inclusion is not only related to binary gender, ethnic and cultural background, but also disability, neurodiversity, sexual orientation, and gender diversity [e.g., Ali et al., 2021]. When focusing on gender diversity and inclusion, it is well understood that gender is not binary [e.g., Spizzirri et al., 2021], and important to ensure that all relevant barriers are considered, such that proposed solutions benefit all people.

These inequities are not only observed in the workforce but also professional geoscience 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 [Mukasa, 2009; Holmes et al., 2011; Lincoln et al., 2012; Holmes et al., 2015; Fernandes et al., 2020]. Historically, women of color are rarely nominated or selected for leadership positions and awards [Ceci et al., 2009; 2014] and there is even less visibility within our organizations of gender-diverse people. Professional organizations thus have an important role to play in driving change, alongside those efforts made by workplaces and legislated for by governments.

Gender discrimination in prestigious geoscience professional society awards was first recognized by Mukasa [2009]. Since then, the AGU has further acknowledged this discrimination in Holmes et al. [2011] and Mogk [2021]. More recently the AGU published a press release of their diversity efforts [Lerback and Hanson, 2017] and also released a Diversity, Equity, and Inclusion (DEI) Strategic Plan that recognizes the critical need for a DEI strategy for the organization to be successful [American Geophysical Union, 2018]. The Geological Society of America publishes regular DEI 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, and 2021 [White, 2021]. The GSA also has a position statement fully dedicated to “Removing Barriers to Career Progression for Women in the Geosciences”². AAPG has worked towards supporting women members in the last decade, including the establishment of a code of conduct in 2018, a Women’s mentoring program, and an AAPG Women’s Network Special Interest Group (previously PROWESS) with a mission to “increase participation and advancement of women.” Because other major geoscience professional organizations have historically and more recently completed studies examining the internal gender balance of key roles [e.g., Mukasa, 2009; Holmes et al., 2011; Fernandes et al., 2020; Handley et al., 2020], we have the moral and ethical obligation to undertake such a review for AAPG [cf. Mogk, 2021]. In doing so, we note the importance of qualitative, autoethnographic, and intersectional studies on this topic, connecting personal experiences with social and political context [e.g., Crenshaw, 1989; 2018; Williams, 2021]; quantitative studies are useful, but not fully comprehensive. We also note the prevalence of focus on women, and the importance of ensuring progress is made toward inclusion and recognition of gender diversity and people of color within our professional organizations.

Since AAPG plays a major role in the energy geoscience workforce landscape, examining metrics of gender inequity within AAPG is critical to continued efforts to diversify the workforce. A presentation at the AAPG ICE (International Convention and Exhibition) 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 the representation of other historically under-represented groups. Upon the presentation of this data, little has been done to formally address this issue within AAPG’s structure and bylaws. This highlights the need for further study and making recommendations that will elevate the status of marginalized peoples within AAPG and other professional societies.

² https://www.geosociety.org/documents/gsa/positions/pos26_RemovingBarriersToWomen.pdf, accessed 20 February 2023.

Rachelle Kernen et al.

The goals of this study are to 1) compile and 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, or held distinguished lecturer positions; 2) compare data to that available from other geoscience professional organizations including the GSA and AGU; and 3) provide recommendations for future initiatives and policy based on the results of the data analysis, documented literature, review of other societies' DEI strategies, and the experiences of the authors through their involvement with this esteemed professional society.

2. AAPG Structure and Code of Conduct

AAPG was founded in 1917 to foster scientific research, advance the science of geology, promote technology, and inspire high professional conduct³. The association accomplishes these goals by providing publications, conferences, and educational opportunities to geoscientists. Historically, the focus of AAPG has been on the science of petroleum geology and recently has been including the sustainable development of CO² storage, H² 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 2022, AAPG's membership number dropped to 19,327 individuals. Typically, membership numbers mimic the economic cyclicality in the petroleum market, however, energy markets performed at record highs in 2022. The geographic membership of AAPG is subdivided into AAPG Sections and Regions. The AAPG Sections consist of six US-based Sections (Eastern, Gulf Coast, Mid-Continent, Pacific, Rocky Mountain, and Southwest). The AAPG Regions consist of six Regions (Africa, Asia/Pacific, Canada, Europe, Latin America and the Caribbean, and the Middle East).

AAPG has an Executive Committee which serves as a Board of Directors, and an Advisory Council, whose membership includes a representative for each AAPG Region and Section and has oversight of several committees, including one focused on Honours and Awards. The Honours and Awards Committee is responsible for the coordination of the AAPG Honours and Awards program; meetings are run following Robert's Rules of Order. Motions passed by the

³ Code of Conduct: <https://www.aapg.org/code-of-conduct>, accessed 20 February 2023.

Advisory Council are submitted to the Executive Committee for consideration and approval. The AAPG also has a House of Delegates, whose members are elected by popular vote, and is responsible for the legislative function of the organization.

3. Methods

The gender distribution data of officers, awardees, and leaders utilized in this study were compiled from annual reports provided to the authors by the AAPG, GSA, and AGU staff. In the case of AAPG, the historical data presented is from 1917-2020. Between the three organizations, the award history was compared to the membership population from 2014-2020. The authors assigned gender to AAPG members and utilized historical knowledge provided by several key AAPG leadership personnel, whose experience spans 1980-present to best assign gender to names in the data provided. If the gender was not able to be determined, the authors assigned “unknown” against gender. GSA Executive Director Vicki McConnell and AGU Director for Business Data and Intelligence Karine Blaufuss provided membership and award data to the authors with the gender pre-determined.

To date, there has not been an opportunity for AAPG members to express gender outside of the male-female binary and therefore this analysis is incomplete. The authors recognize that researchers and committees may be discouraged from undertaking this type of study because it is deemed too hard or professionally limiting [Jones et al., 2019; Ryan and Hermann-Wilmarth, 2019] or deviate from methods that include gender-diverse individuals [Allen et al., 2014]. Researchers have also raised the challenges of managing ethics review boards 'concerns for participants' well-being [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]. It is important to acknowledge 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 is thus inherently flawed, but the best attempt possible; the authors request of readers that these above-mentioned

Rachelle Kernen et al.

considerations are incorporated in any interpretations or use of data presented herein.

4. Data Analysis

4.1 Executive Committee Leadership

Since 1917 there have been 1,138 Executive Committee leadership positions within AAPG and its divisions (Division of Professional Affairs-DPA; Division of Environmental Geoscientists-DEG; Energy & Minerals Division-EMD; Petroleum Structure and the Geomechanics Division-PSGD is not included because of the lack of data collection). The first woman was elected to a leadership position in 1987; since then, 145 women (13%) have held leadership positions (Figures 1, 2, 3).

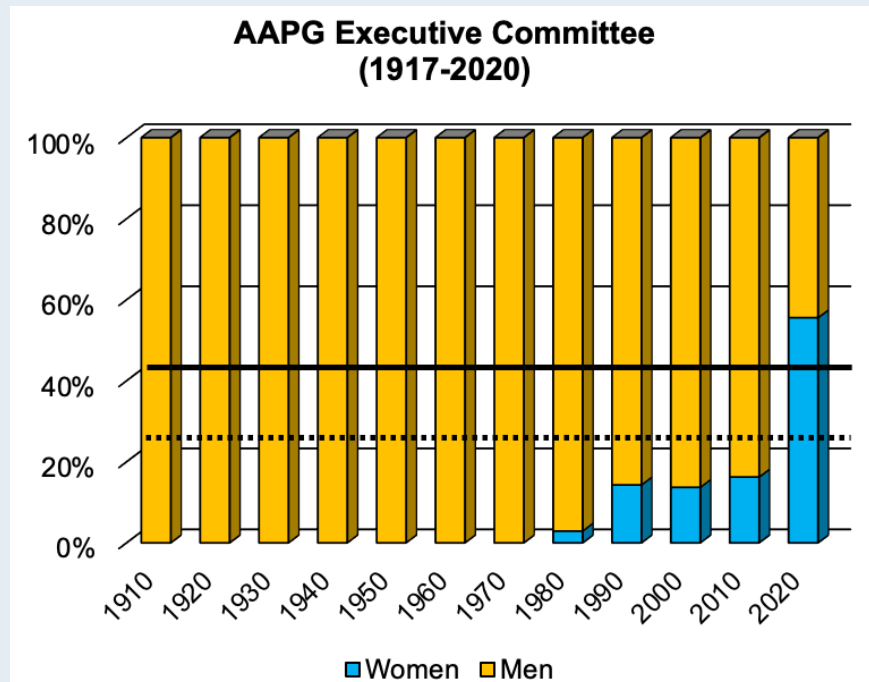


Figure 1. The number of women and men in AAPG's Executive Committee. AAPG's women's membership in 2020 is 21% (black dotted line). Women's geoscience enrollment and graduation rate in 2020 is 40% (black line).

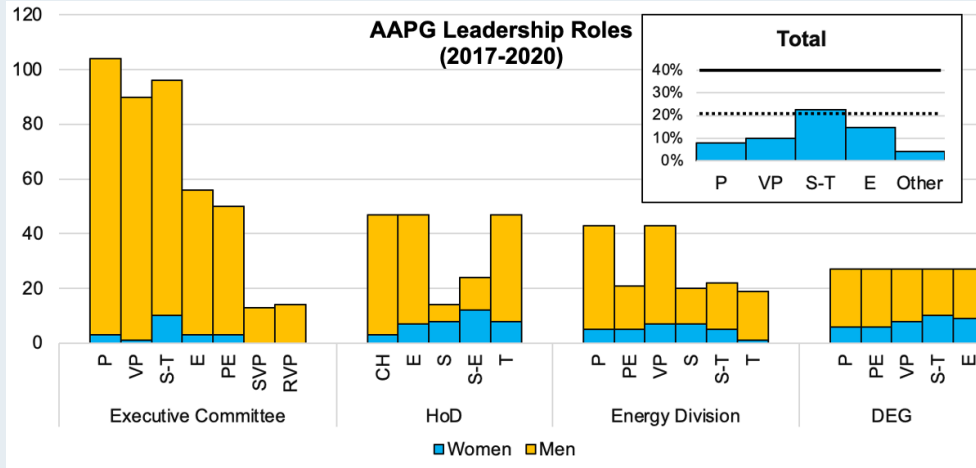


Figure 2. The total number of women and men in AAPG leadership roles from 1917-2020 with the percentage of roles held by women (top right). P = president, VP=vice president, S = secretary, E = editor, PE= president-elect, SVP= sections vice president, RVP = regions vice president, CH= chairman, and T=treasurer. HoD = House of Delegates, EMD = Energy Mining Division, and DEG = Division of Environmental Geoscientists. The percentage of women's membership in 2020 is 21% (black dotted line). Women's geoscience enrollment and graduation rate in 2020 is 40% (black line).

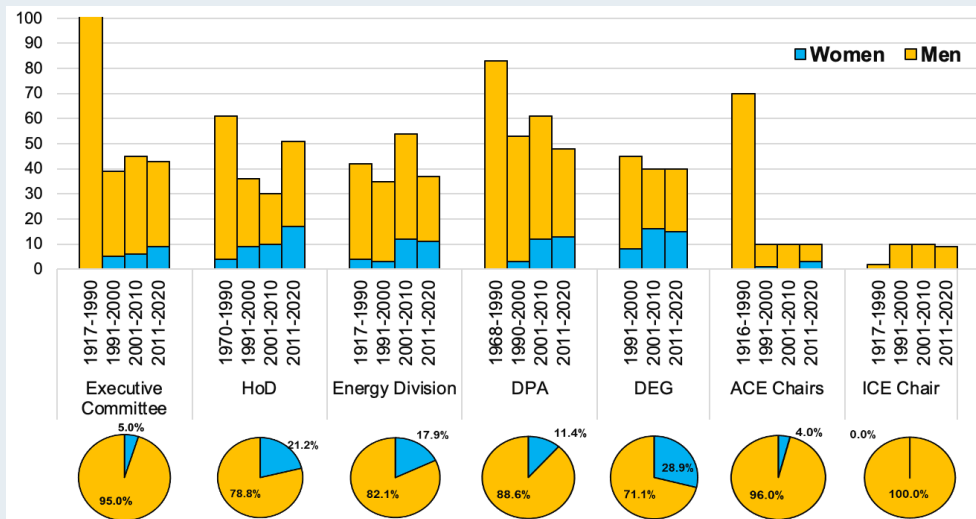


Figure 3. The total number of women and men in AAPG executive committees and leadership positions from 1917-2020. HoD = House of Delegates, EMD = Energy Mining Division, DPA=Division of Professional Affairs, DEG = Division of Environmental Geoscientists, ACE=Annual Convention and Exhibition, ICE=International Conference and Exhibition.

Rachelle Kernen et al.

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 percentage of women ranges from 1.8% to 21%, with an average of 5.5%. The percentage of women in leadership has been increasing; 2020 marks the largest number of women in leadership when women held 10 (46%) of the 22 positions. Robbie Gries [2001-02], Randi Martinsen [2014-15], and Denise Cox [2018-19] are the only women to serve as AAPG President as of 2020. From 2021-22, Gretchen Gillis and 2023-24 Claudia Hackbarth, both women, will have served as AAPG President, outside of the data reporting window for this study. Martha Lou Broussard [1987-88], Brenda Cunningham [1990-91], and Valary Schulz [2004-05] have been the only women to serve as Chair of the House of Delegates as of 2020. From 2021-22, Kristie Ferguson, a woman, served as Chair of the House of Delegates but is not represented in the graphs and data collection window.

4.2 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 (Figures 4 & 5). Viewing the data most optimistically, 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. In 1963, the first award granted to a woman was an Honorary Member Award to Dollie Radler Hall. 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 percentage of women recipients 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 (Figures 4 and 5). As of 2020, a woman has never received AAPG's highest honor, the Sidney Powers Memorial Award.

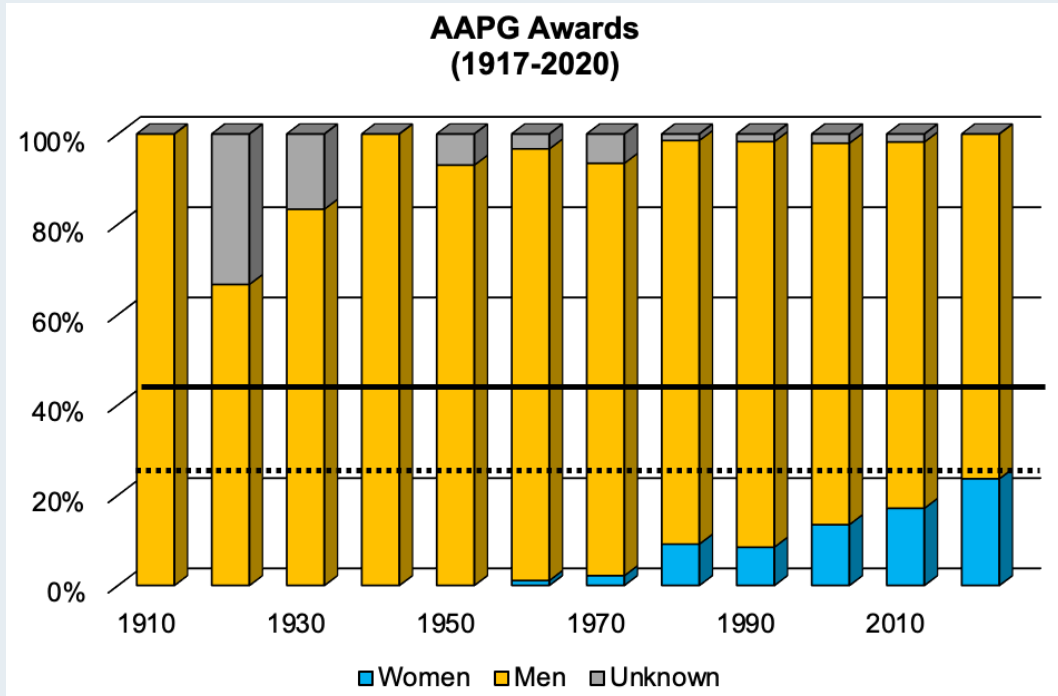
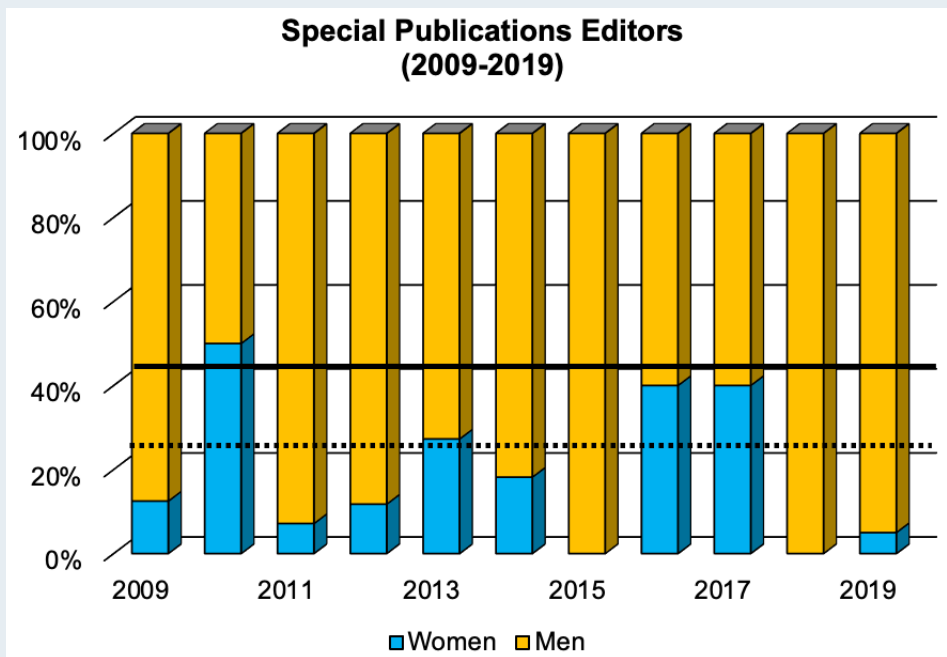


Figure 4. The number of women and men (including unknown/other genders) of AAPG awardees from 1917-2020. The percentage of women's membership in 2020 is 21% (black dotted line). Women's geoscience enrollment and graduation rate in 2020 is 40% (black line).

4.3 Special Publication Editors, Distinguished Lecturers, Technical Roles

The previous and current editorial teams for AAPG’s publications also lack diversity and equity. Editorial teams (Associate Editors) 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, Doris Malkin Curtis, served in 1982. Over the last two decades, the percentage of women Distinguished Lecturers have leveled off, but is highly variable, with the lowest representation being 6% in 2007 (Figure 6).

AAPG lists instructors 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 listed 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%).



Rachelle Kernen et al.

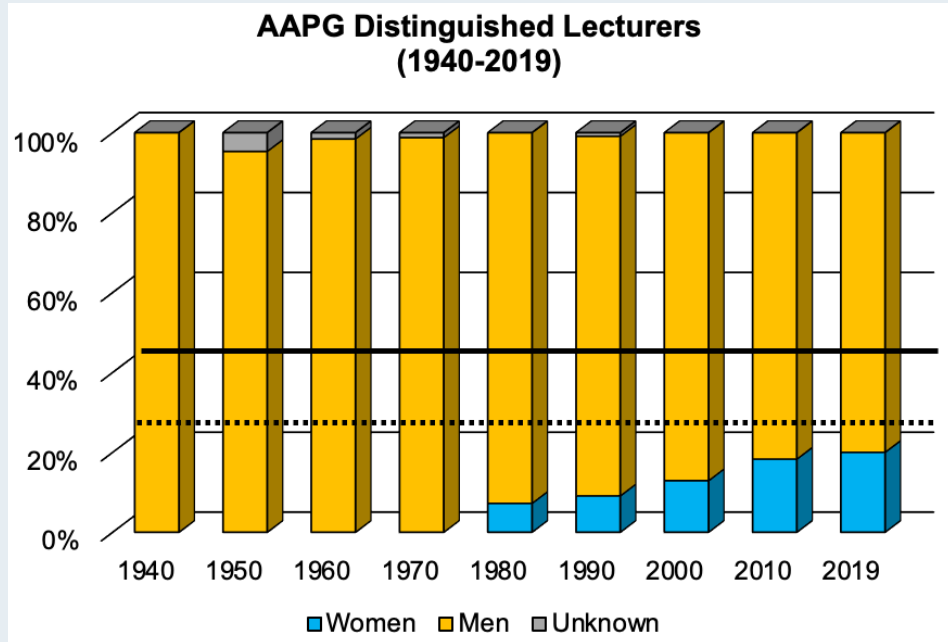


Figure 6. The number of men and women (including unknown and other genders) who served on Special Publication editorial boards and as Distinguished Lecturers. The percentage of women's membership in 2020 is 21% (black dotted line). Women's geoscience enrollment and graduation rate in 2020 is 40% (black line).

4.4 Comparing AAPG data to that from the AGU and GSA

AAPG's percentage of women membership to women awardees is compared with GSA and AGU (Figure 7). AAPG membership data indicate that women's membership has hovered between 19-21% since 2014, and before that (1917-2014), women's 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.

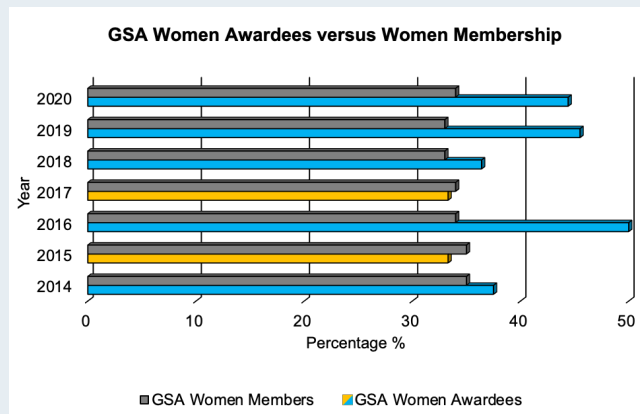
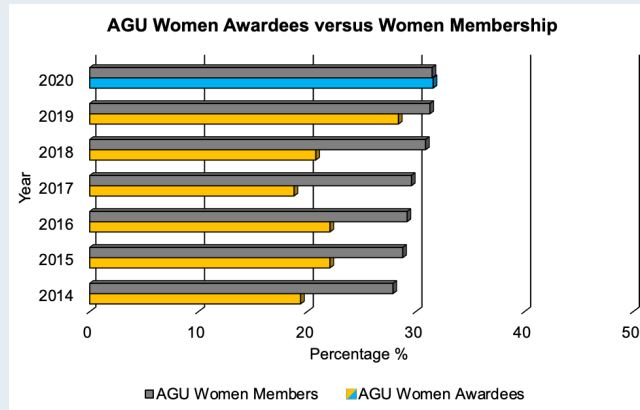
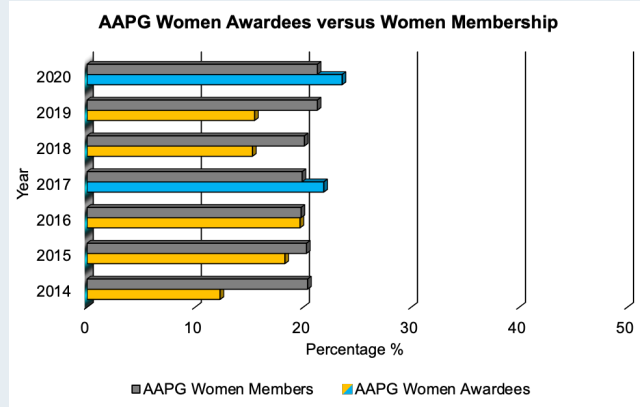


Figure 7. The percentage of women awardees compared to the overall percentage of women members, for AAPG, AGU, and GSA. Gray indicates the percentage of women who are members of the organization. Yellow indicates when the percentage of the women receiving awards was less than the percentage of the women membership. Blue indicates when the percentage of the women receiving awards was greater than the percentage of the women membership.

5. Results

The AAPG trails behind other large geoscience organizations, like GSA and AGU, in membership of women and diversity and inclusion efforts, programs, and frameworks (Figure 7a-c). While the proportion of women in leadership roles and awards started to increase in the 1980s, 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 (Figure 7a) is striking, particularly when compared against similar data from GSA and AGU (Figure 7b, c). AAPG women's membership totals are lower than that of GSA and AGU and AAPG awardees are consistently inequitable in comparison to the percentage of their AAPG membership (Figure 5a). Of these three organizations, the proportion of women award winners is the highest in the 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 DEI 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.

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

1. Martha Lou Broussard (Chairman, House of Delegates) and Sandra C. Feldman (Secretary-Treasurer, Energy and Minerals Division) were the first women to be elected to an executive committee position within AAPG was 1987.
2. Since it was founded in 1917, women have held only 5% of executive leadership roles in AAPG.
3. Women have most often served as Secretary and/or Treasurer.
4. Women held 20 positions in the Executive Committee since 1917, however, only 15 different women have won and accepted these roles. The same women often serve in multiple roles through time (ie. Denise Cox and Robbie Gries as Secretary then President, Randi Martinsen as Treasurer then President).

5. Only 4% of ACE (Annual Convention and Exhibition) Chairs have been women. No woman has ever been an ICE (International Convention and Exhibition) Chair.
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 Memorial Award.
9. Women serving as AAPG Bulletin Editors is highly variable year to year with an average of 28%.
10. Before 2000, only 7% of AAPG's Distinguished Lecturers were women. That number has climbed to 18% in the last two decades and has since leveled off.
11. Only 9% of Visiting Instructors and 18% of Visiting Geoscientists have been women.
12. In 2020, women comprise 21% of the members of AAPG, 32% of AGU, and 34% of GSA.
13. GSA leads in awards to women, followed by AGU and AAPG.
14. There have been zero openly gender-diverse people in positions of leadership or have received an award in the history of the society.
15. Stephanie Nwoko is the first black woman to hold a position (Secretary) on the Executive Committee (2019 – 2021).
16. Elvira Gomez-Hernandez is the first Latina to hold a position (Regions Vice President) on the Executive Committee (2021 – 2023).
17. Jonathan Allen is the first openly gay man to hold a position (Secretary) on the Executive Committee (2021 – 2023).

6. Discussion

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” and often after recognizing that the barriers are systemic and institutionalized [Fouad

Rachelle Kernen et al.

et al., 2017; Cech and Blair-Loy, 2019, Popp et al., 2019; Berhe et al., 2022]. Many studies have identified factors or reasons that contribute to women leaving geoscience, which include, but are 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 people of color 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 people of color geoscientists [Baber et al., 2018; Callahan et al., 2015; Ceci et al., 2009; 2014; Estrada et al., 2018; Holmes et al., 2008; Holmes and O'Connell, 2003; Newton, 2012; Stokes et al., 2015; Williams, 2012; Williams, 2017; Williams, 2021]. These provide useful focal points for organizations, including professional societies such as AAPG, to consider when developing processes and policies to include people of color and marginalised genders.

Another important observation is that historically, there has been a 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 (Figures 4, 7). This phenomenon was first reported by the AGU in their award results from 1999-2010 by Holmes et al. [2011]. AAPG has recently reserved the Secretary position for Young Professionals to provide an opportunity for that demographic; this is a valuable step towards diversifying the AAPG leadership group yet also substantiates the perception that this is not one of the most esteemed of roles. This "service tax" often experienced by women throughout their careers ultimately impedes attaining higher level awards, like the Sidney Powers Memorial Award for example. Commonly, women are pigeonholed in service, support, teaching, secretary, and administrative roles instead of leadership and technical positions, which ultimately hinders them from being competitive for even more prestigious technical roles, awards, submitting first-author academic manuscripts for publication, and submitting research grant proposals [Holmes et al., 2011; Witze, 2016; Lerback & Hanson, 2017; Pico et al., 2020]. Women spending more time in such roles is a contributing factor as to why so many never make it to the highest leadership levels among professional societies, academic institutions, or executive industry positions.

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].

7. Recommendations: Call to action

The data in this study, and notable gaps in data collected, specifically highlight and identify 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-diverse members, it is key that the broad membership of the association acknowledges that these disparities exist in the first place. This data analysis provides clear evidence for that bias and discrimination. 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.

"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 members 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 the Institutional Review Board (IRB) guidelines to establish metrics to benchmark DEI efforts and programs. To facilitate future DEI efforts, AAPG needs to collect anonymous data that includes the option to select gender, race, ethnicity, and disability (i.e., sensory, mobility, and cognitive). Questions about gender identity should include options beyond "male", "female", and "transgender"

Rachelle Kernen et al.

[Matsuno and Budge, 2017]. Many different gender identities have been defined, and boundaries between the categories can overlap [Spizzirri et al., 2021]. That such data collection be anonymous is essential, because where gender-diverse options are included in questionnaires, people who have been treated with disrespect, abuse, and discrimination because of their gender may be unwilling to reveal this information [Australian Bureau of Statistics, 2018; Jones et al., 2021]. The estimated proportion of people who are not cisgender (i.e., they are gender-diverse) ranges between 0.1 – 2% [Spizzirri et al., 2021]. Thus, if AAPG membership were representative of the population, as should be the goal of a professional organization, then based on 2022 membership, there should be between 19 – 387 gender-diverse members at present (and during past membership peaks, between 40 – 800 members).

The proposed membership demographic survey results need to be published yearly to ensure transparency and thus appropriate solutions can be made. At a minimum and at all levels of the organization, AAPG needs to become gender, racial, and ethnically balanced concerning AAPG's overall membership. AAPG's Code of Ethics provides a framework for appropriate professional behavior, however, this Code of Ethics lacks DEI standards. The authors recommend that AAPG establishes a DEI 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 increase 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 a 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 fosters 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 DEI policies, women and gender-diverse members need to be nominated for AAPG awards and positions by their peers in significantly higher numbers. To address this issue, the authors suggest having a diverse pool of candidates to choose from (many workplaces and organizations 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 officer nominations. The AAPG Women's Network then makes its recommendations to the Advisory Council Honor and Awards Committee which is responsible for determining award recipients. This work should 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.

As an example, the Australian Academy of Science [2020] has made significant strides in recent years to address the issue of gender imbalance in their fellowship,

Rachelle Kernen et al.

leadership, and grant and award winners. They have adopted a range of best practice measures to improve their nomination process and increase opportunities to recognize all scientists⁴. For AAPG to encourage a diverse pool of candidates as award recipients, we propose the following DEI Award Selection Framework is adopted (adapted from the Australian Academy of Science, 2022):

1. Candidates from diverse backgrounds may be suggested (in confidence) to the Honors and Awards Committee.
2. All members of the Honors and Awards Committee undertake unconscious bias training and then shortlist candidates to progress for further consideration. Additional independent referee reports are requested for shortlisted candidates.
3. Honors and Award Committee meets to determine the final candidates to recommend for each award. Each committee member may recommend up to two candidates if one gender is represented, or three candidates if more than one gender is represented.
4. Honors and Award Committee members considers all the recommended candidates and determine the final list of candidates for each award. Two-thirds of the voting members must agree to each candidate's election.

It is important that all future efforts AAPG take to improve diversity and inclusion are undertaken across all facets of the organization, and that the work is not disproportionately undertaken by women and people of color, such as the AAPG Women's Network and STEMULATING Diversity Special Interest Group. We recommend that AAPG consider adopting a similar approach to the AGU, in employing a person or team to recognize the substantial nature and importance of the work. To change the culture, inclusive behaviors must come from the top of the organization (Director and President) and be modeled every day, at every conference and online meeting. This inclusive message must be reinforced regularly in the Explorer, Bulletin, annual reports, and newsletters from the President and Executive Committee.

Although AAPG has started to make strides toward gender equity in recent years, especially since 2019, there are still significant inequities that 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.

⁴ We highly recommend looking at the information provided at www.science.org.au

AAPG must include historically under-represented members and students in conversations, leadership positions, and 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 marginalized groups, including women and people of color, we lose first-generation students because of a lack of quality mentoring and sponsorship and significant financial barriers like paying for conference travel and accommodation and publishing manuscripts. 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 marginalized women such as women of color and Indigenous women [as discussed by Suzack et al., 2010 and O'Sullivan et al., 2019 and references cited therein]; it is thus also imperative to address gender equity issues concerning race and ethnicity. For this, the authors highly recommend referring to Ali et al. [2021] "An actionable anti-racist plan for geoscience organizations."

8. Conclusions

For AAPG and other professional geological societies to be successful and technically innovative in the future, they need to recognize, embrace, and uplift historically under-represented populations and all other marginalized members by becoming more diverse and inclusive. This study provides a base framework of demographic data for AAPG, which is needed to analyze gender equity and diversity across all professional societies and organizations. Historical data from 1917 – 2020 were compiled, presented, and analyzed, focusing on the gender distribution of membership, officers, awardees, and leaders across the association. These were compared with similar data from the GSA and AGU. In summary, it is notable that substantially more men have received awards and held positions of authority than women over the years, with the most uplift taking place in the past 10 years. AAPG women's membership totals are lower than that of GSA and AGU, and AAPG awardees are consistently inequitable.

We recommend that race and gender diversity data need to be collected and published publicly for members of AAPG to view and make recommendations for

Rachelle Kernen et al.

improving the diversity and inclusion policy. It is imperative that AAPG leadership consistently demonstrate inclusive behaviors daily to spark a permanent culture shift. Inclusive messaging can be reinforced regularly in the Explorer, Bulletin, annual reports, and newsletters from the President and Executive Committee. We provide evidence highlighting how and why diversity and inclusion are important and highly encourage a cultural shift to take place within the greater AAPG organization. We recommend that the AAPG increases women's representation at all organizational levels (from Session Chairs and Distinguished Lecturers to committee leadership). By supporting the Women's Network and STEMulating Diversity Special Interest Group initiatives and, importantly, hiring a DEI staff member, it will allow diversity and inclusion practices to have greater influence over the AAPG community. Each member, leader, and staff member of the AAPG needs to be informed about the gender, racial, and ethnic inequities that exist within the organization and commit to improving the overall experience of members (e.g., through AAPG communications and activities). By implementing a Position Statement, organizational-wide DEI Strategy, and DEI Award Selection Framework for the award selection process (each policy outlined in our Call-to-Action), members who are women, gender diverse, and people of color need to be recognized and genuinely included through a shift in the balance of power at all levels of the organization.

Acknowledgements. This paper is the result of many years of research, data analysis, discussions, and actions; many of which were undertaken by the AAPG Women's Network and through discussions between some of the authors and leadership within the AAPG. The work for this paper began in 2020 with the support of AAPG leadership. An earlier version of this paper was submitted to AAPG GeoHorizons for consideration in early 2021 (made available on EarthArXiv) and was accepted pending revisions. The revisions were engaged with in good faith, through two resubmissions and two editors, however, the authors, reviewers, and editors could not agree on a final version. In November 2022 the authors withdrew the manuscript from AAPG GeoHorizons. We acknowledge and thank the reviewers and editors who provided constructive feedback on this and prior versions of the manuscript, for both the AAPG and the Journal of Geoethics and Social Geosciences. The authors sincerely thank GSA Executive Director Vicki McConnell and AGU Director for Business Data and Intelligence Karine Blaufuss for providing datasets to compare to the AAPG data. Special thanks to Dr. Christine Williams, Professor of Sociology, and the Elsie and Stanley E. (Skinny) Adams Sr. Centennial Professor in Liberal Arts from The University of Texas at Austin for hosting mentoring sessions with the authors and providing sociology literature for background research.

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