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

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	<p>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. 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 historical AAPG membership data in this study 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 presently with a reduced opportunity to influence. By addressing these issues, 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 as professional geoscientists.</p>
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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 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 against similar data from the American Geophysical Union (AGU), and the Geological Society of America (GSA). 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 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 review of published literature and actions to improve equity diversity and inclusion in other professional societies/organizations, 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 presently with a reduced opportunity to influence. We note and include reference to literature on this topic, that it is imperative that gender equity issues are addressed with respect to race and ethnicity. Specific actions should be taken to provide support for marginalized women such as women of color and First Nations/Indigenous women, and gender-diverse people. By addressing these issues, 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 as professional geoscientists.

Introduction

Indicators of gender inequality show dramatic improvement over the past ~40 years (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). Some 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. 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 gender diverse 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). As a result, underrepresented groups produce higher rates of scientific novelty, but their contributions are devalued and discounted (Hofstra et al., 2020).

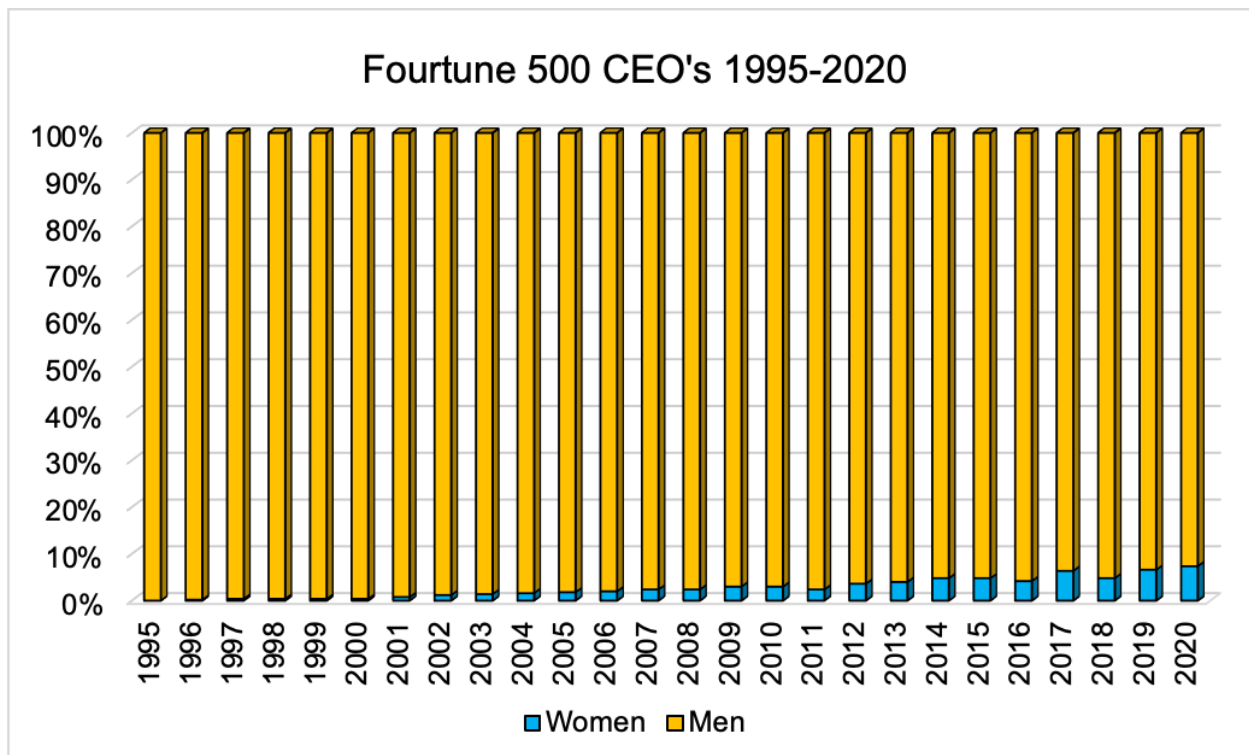


Figure 1: Gender of Fortune 500 CEOs (Hinchliffe, 2020).

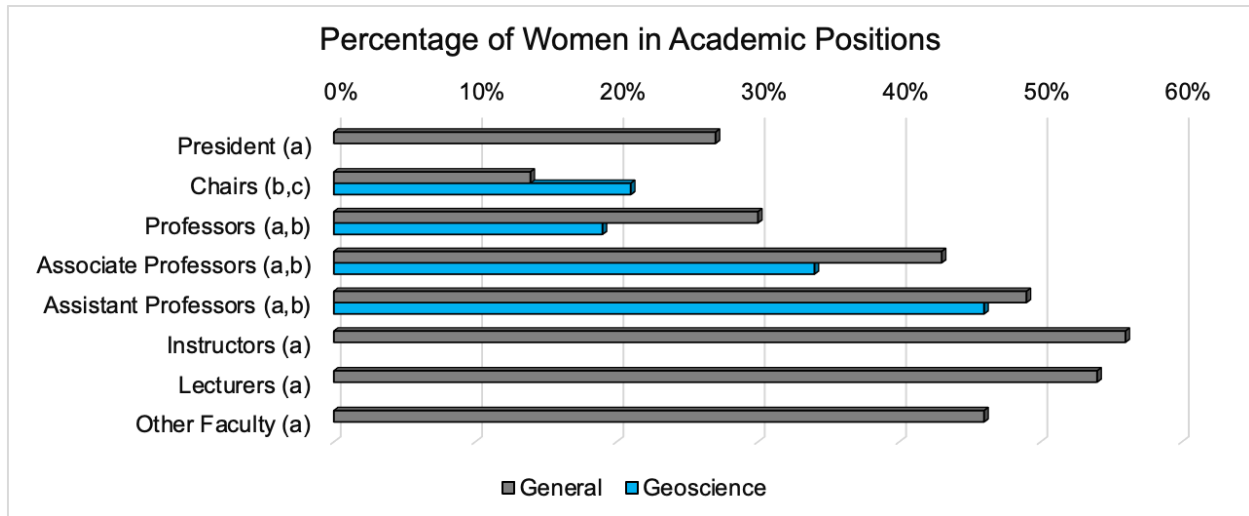


Figure 2: Percentage of women in various academic positions a) U.S. Department of Education, 2017; b) Patterson et al., 2016; c) Ranganathan et al., 2021.

A variety of strategies have been implemented with the aim of boosting representation of women in STEM. These include introduction of mentoring schemes for women; substantial effort placed in developing and setting expectations around codes of conduct; legislated targets for CEOs 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 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. 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 only rose from 11% in 2009 to 15% in 2021 (Australian Bureau of Statistics, 2021).

From 2010-2017, geoscience enrollment and graduation 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 fall 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%.

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 by that of a “hostile obstacle course” to capture the active and continual barriers that women and gender diverse people in science face (Berhe et al., 2022). The geosciences are also 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., 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 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 in 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 (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., 2014). Professional organizations thus have an important role to play in driving change, alongside those efforts made by workplaces and legislated for by governments. This has been acknowledged by the AGU, which not only published a press release of their diversity efforts (Lerback and Hanson, 2017), but released a Diversity, Equity, and Inclusion (DEI) Strategic Plan that recognizes the critical need of a DEI plan for the organization to be successful (American Geophysical Union, 2018). The Geological Society of America publish regular DEI report (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). AAPG has worked towards supporting women members in the last decade, including the establishment of a code of conduct in 2018, 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.” Additionally, the AAPG has launched a range of sustainability initiatives, with a goal of engaging a more diverse range of people; these include a student competition and Distinguished Lecture (2021-22). Because other 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), it is appropriate and important to undertake such a review for AAPG. 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; Williams, 2021); quantitative studies can be useful, but are not comprehensive.

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 representation of other historically under-represented groups.

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 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.

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](#)). 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 international membership of AAPG is sub-divided 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 Caribbean, and Middle East).

The AAPG Executive Committee (EC) serves as the Association's Board of Directors and consists of the following members: 1) President (one year of service), 2) President-Elect (one year of service), 3) Vice President, Sections (two years of service), 4) Vice President, Regions (two years 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). The Chair of the House of Delegates (HoD) is elected by the members of the House, who represent members geographically. The legislative function of the AAPG is the responsibility of the House of Delegates. 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. All positions, except the Chair of the House of Delegates, are elected by the voting members of the Association. A voting member is one whose dues are paid in-full and who have fulfilled the requirements for Member, which does not include students.

The Advisory Council acts in an advisory capacity and comprises 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. Each AAPG Region and Section elects a Councilor to serve on the Advisory Council for three-year terms. If a Section or Region has more than 750 members, their councilor may vote on the Advisory Council. 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.

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 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.

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, 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 non-binary or trans gender 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 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). 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 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 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 (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, 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 in 2023-24 Claudia Hackbarth, both women, will have served as AAPG President, but is not represented in the graphs and data collection window. 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.

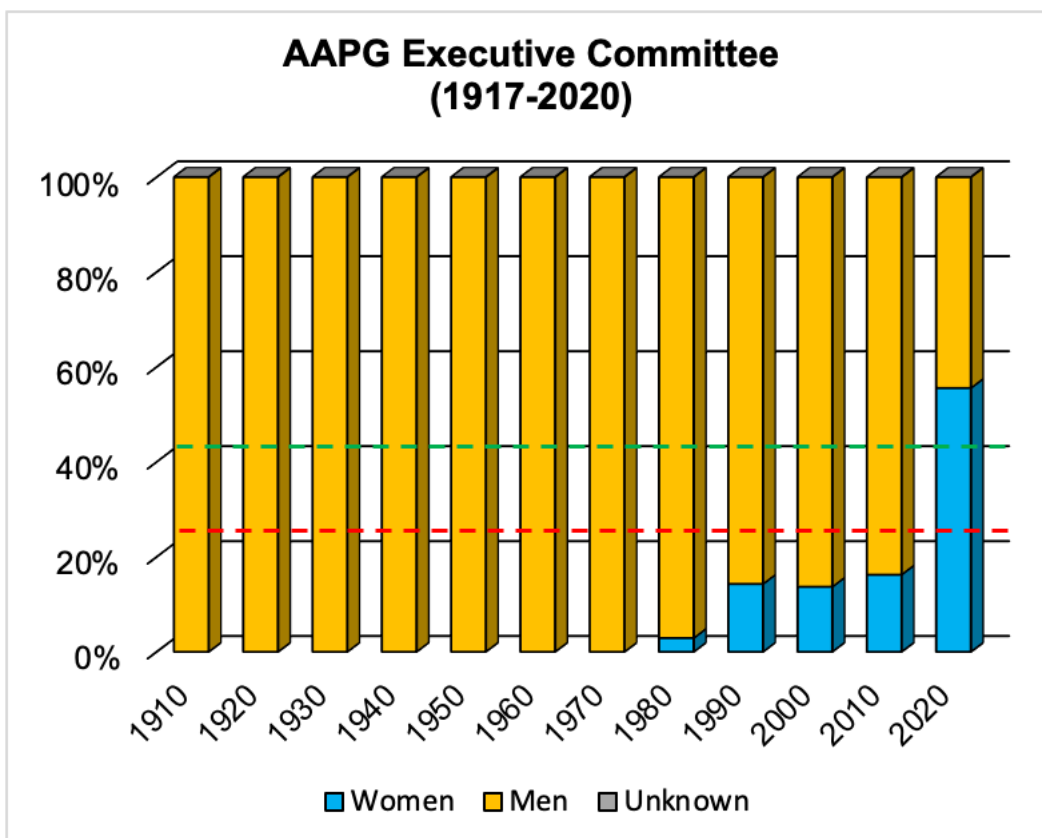


Figure 3: The number of women and men in AAPG's Executive Committee. AAPG's women's membership in 2020 is 21% (red dashed line). Women's geoscience enrollment and graduation rate average is 40% (green dashed line).

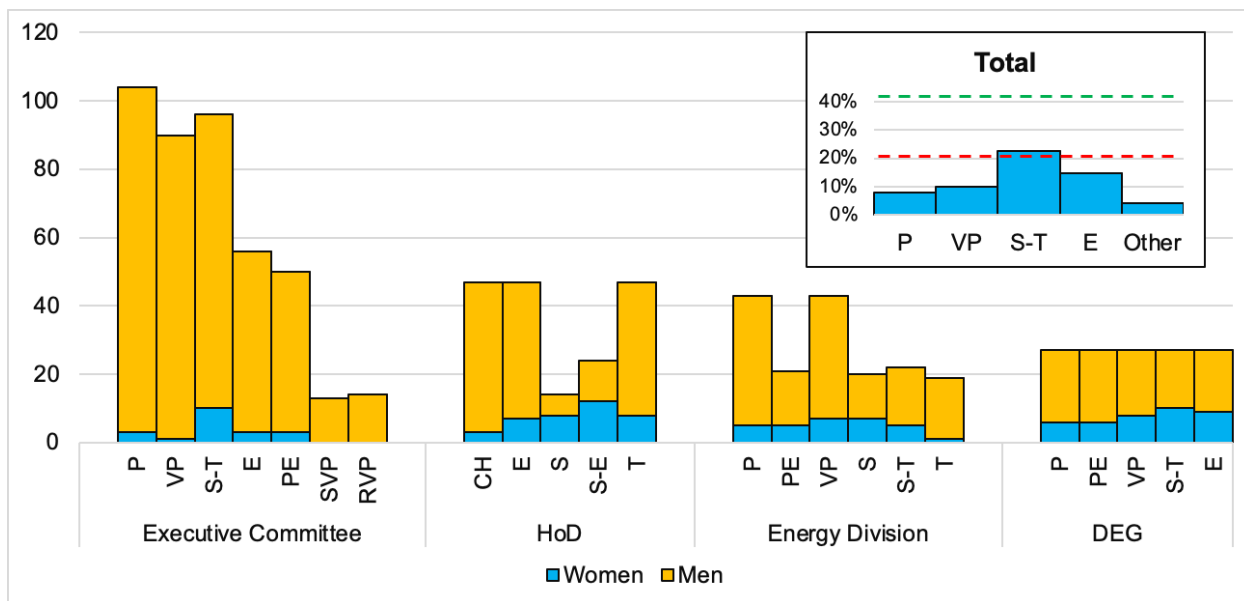


Figure 4: The total number of women and men in AAPG leadership roles from 1917-2020 with percentage of roles held by women (top right). P = president, VP=vice president, S = secretary, E = editor, PE= president elect, SVP= sections vice president, RVP = regions vice president, CH= chairman, and T=treasurer. HoD = House of Delegates, EMD = Energy Mining Division, and DEG = Division of Environmental Geoscientists. The percentage of women’s membership in 2020 is hovering at 21% (red dashed line). Women’s geoscience enrollment and graduation rate average is 40% (green dashed line).

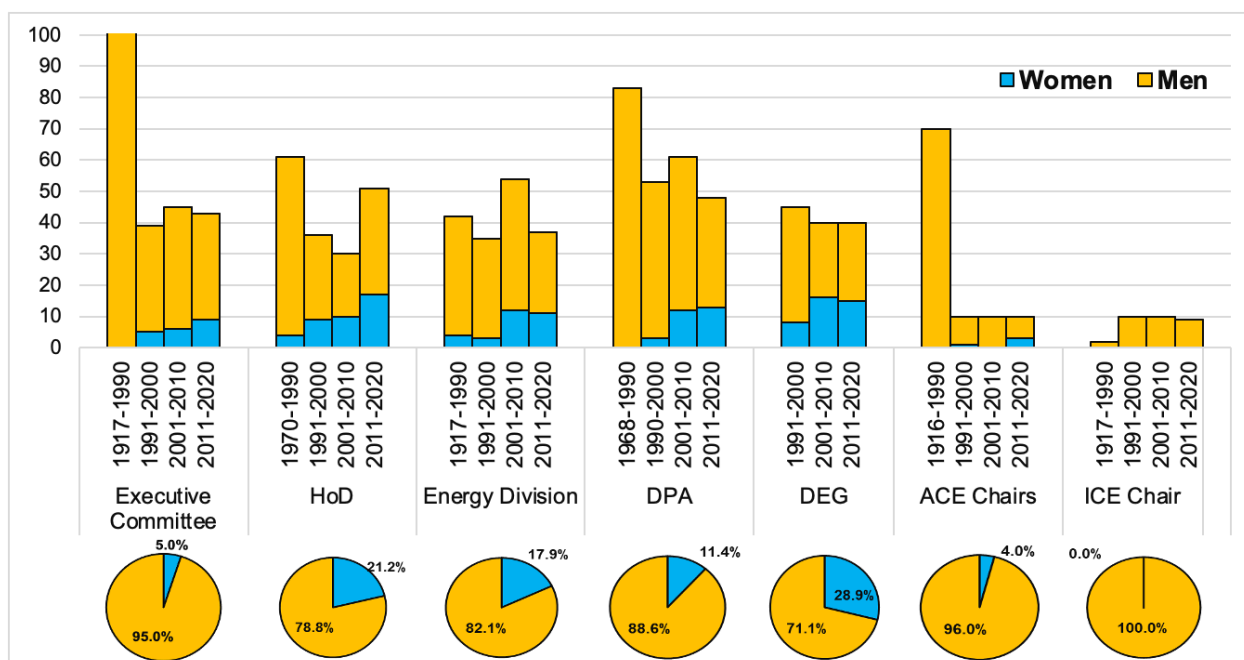


Figure 5: The total number of women and men in AAPG executive committees and leadership positions from 1917-2020. HoD = House of Delegates, EMD = Energy Mining Division, DPA=Division of Professional Affairs, DEG = Division of Environmental Geoscientists, ACE=Annual Convention and Exhibition, ICE=International Conference and Exhibition.

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). 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 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.

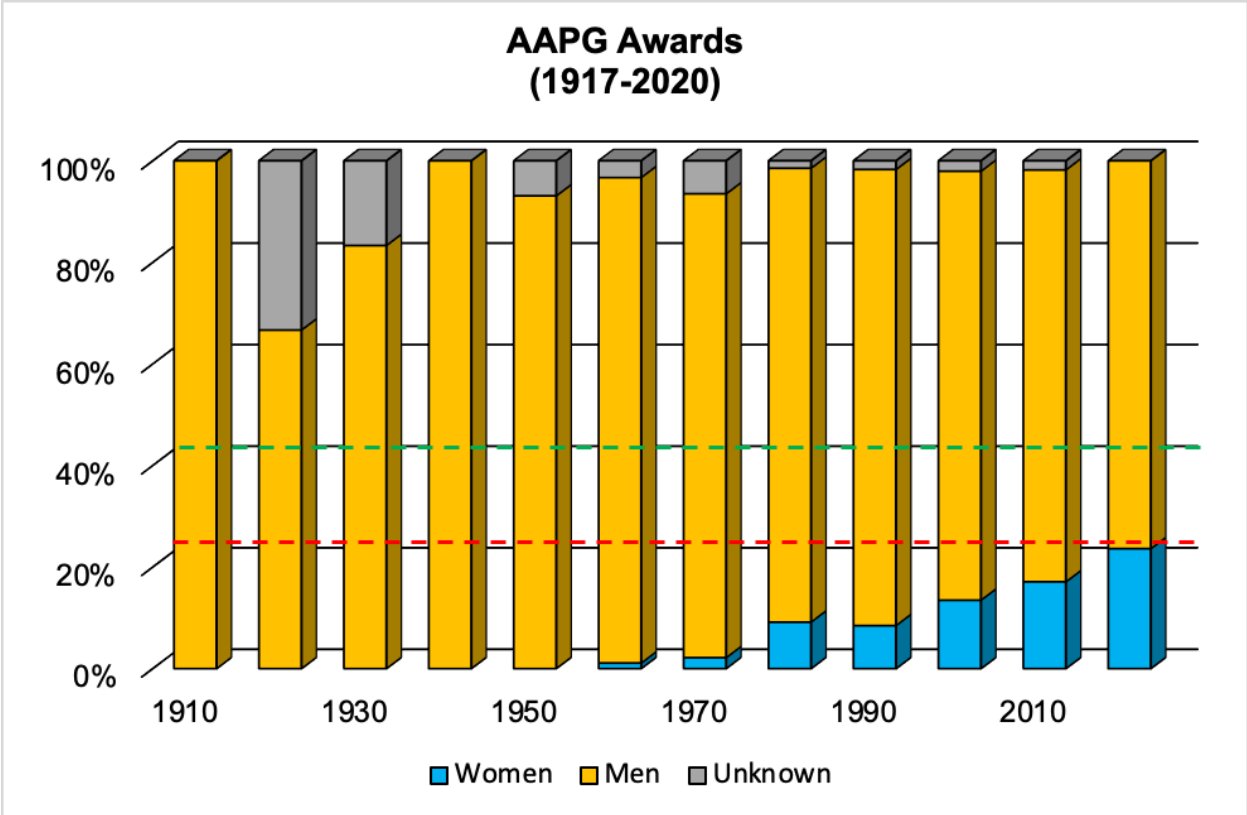


Figure 6: The number of women and men (including unknown/other genders) of AAPG awardees from 1917-2020. The percentage of women’s membership in 2020 is hovering at 21% (red dashed line). Women’s geoscience enrollment and graduation rate average is 40% (green dashed line).

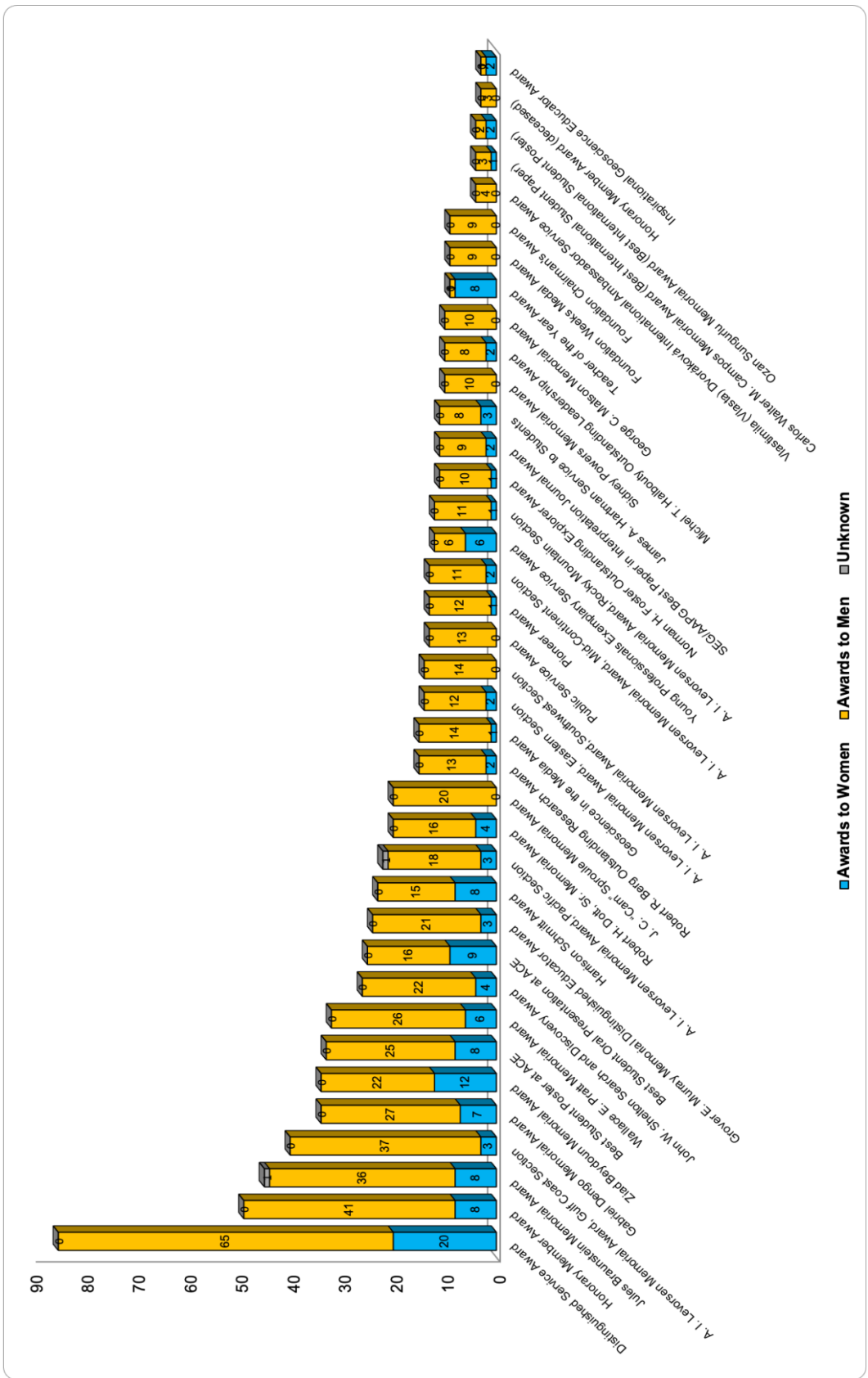
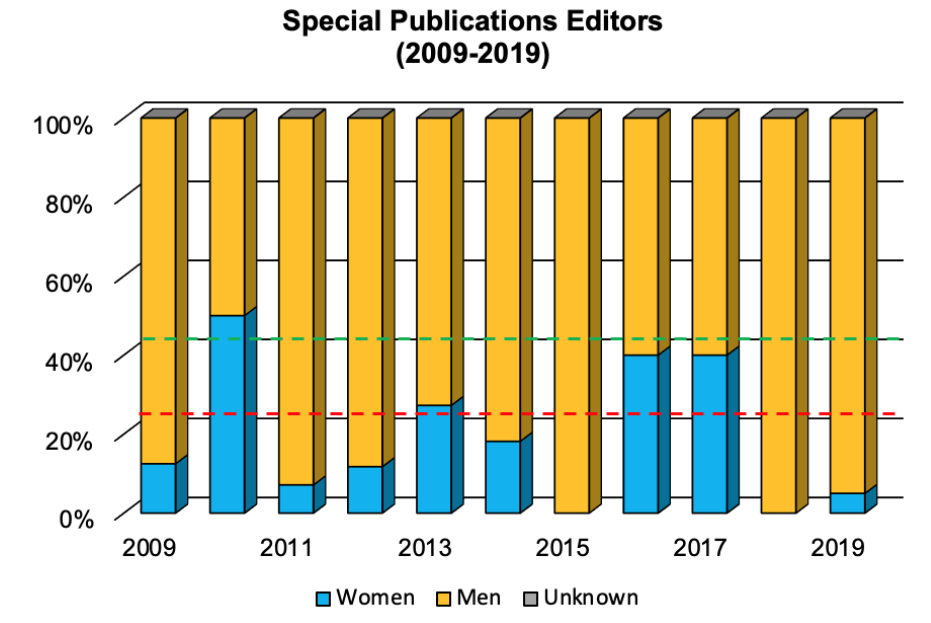


Figure 7: The total number of men and women (including unknown and other genders) AAPG awardees divided by award name.

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 has leveled off, but is highly variable, with the lowest representation being 6% in 2007 (Figure 8a).

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%).



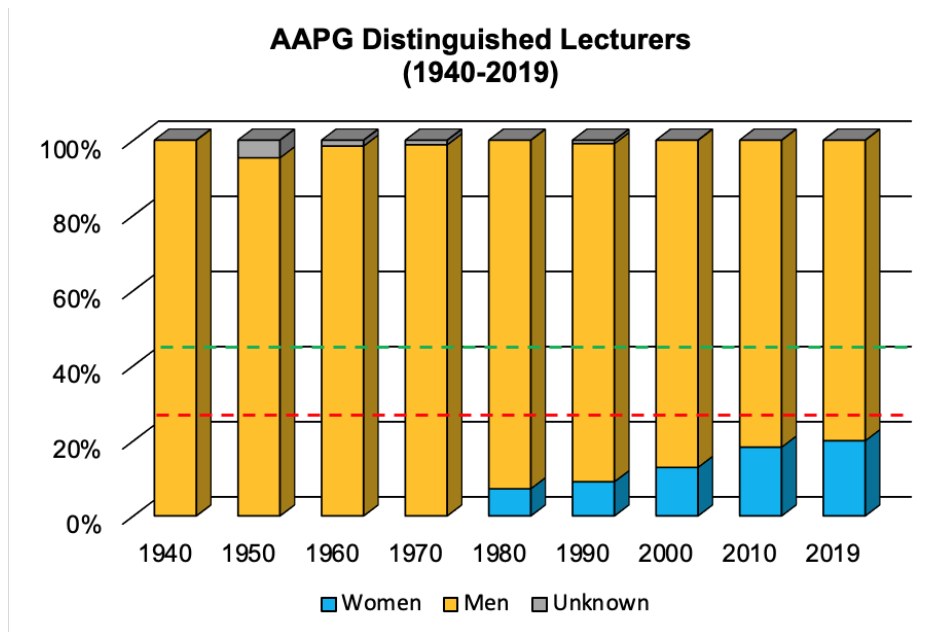
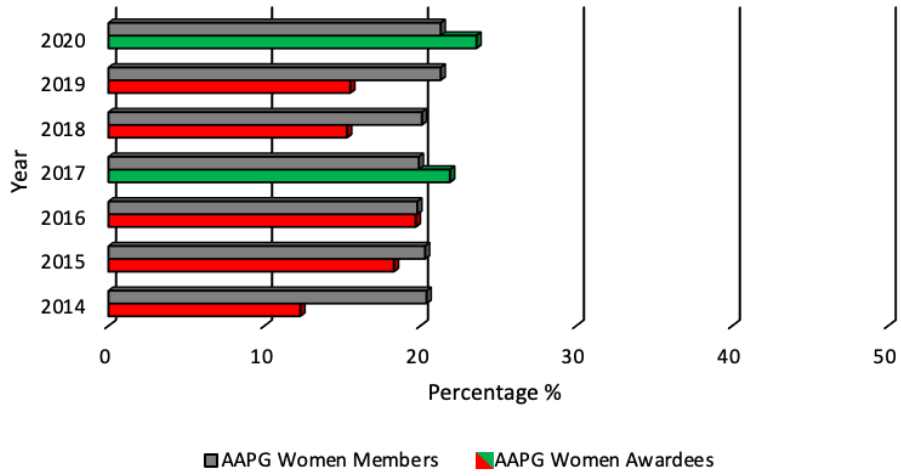


Figure 8: The number of men and women (including unknown and other genders) who served on Special Publication editorial boards and as Distinguished Lecturers. The percentage of women's membership in 2020 is 21% (red dashed line). Women's geoscience enrollment and graduation rate average is 40% (green dashed line).

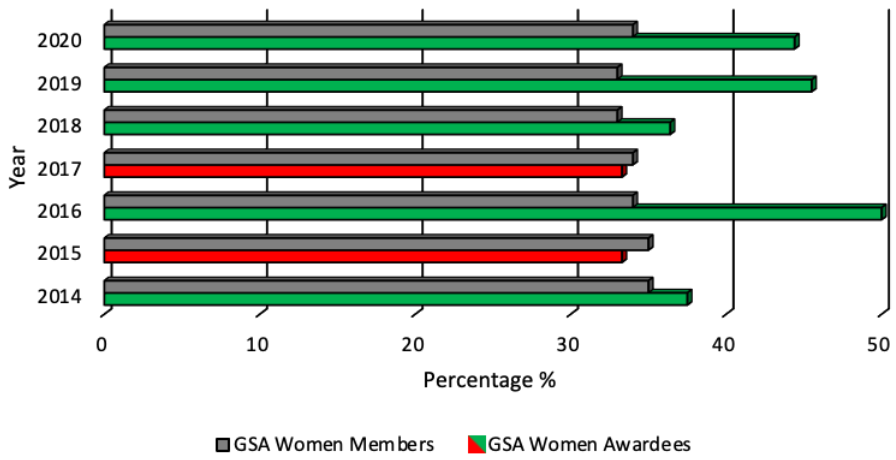
Comparing AAPG data to that from the AGU and GSA

AAPG's percentage of women membership to women awardees is compared with GSA and AGU (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.

AAPG Women Awardees versus Women Membership



GSA Women Awardees versus Women Membership



AGU Women Awardees versus Women Membership

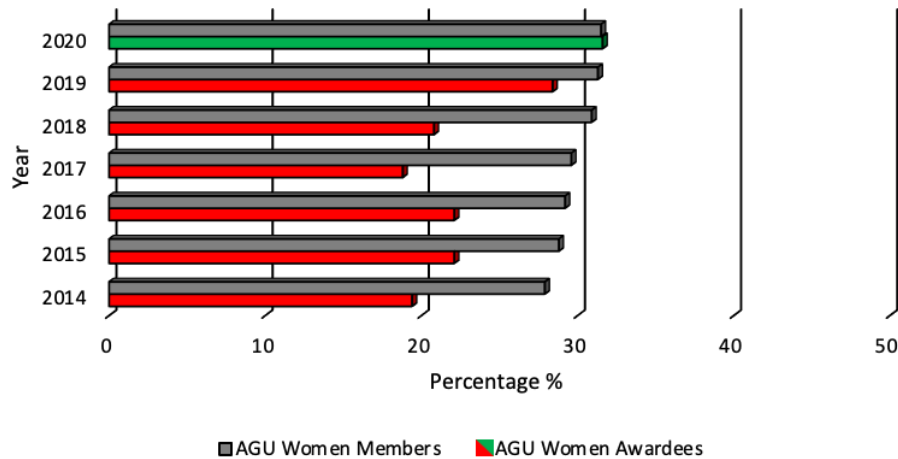


Figure 9: The percentage of women awardees compared to the overall percentage of women members, for AAPG, AGU, and GSA. Gray indicates the percentage of women who are members of the organization. Red indicates when the percentage of the women receiving awards was less than the percentage of the women membership. Green indicates when the percentage of the women receiving awards was greater than the percentage of the women membership.

Key Observations from AAPG Datasets and Reports

In summary, this study of AAPG data highlight 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) *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 have been women.*
- 12) *Women comprise 21% of the members of AAPG (2020), 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 transgender or non-binary 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.*
- 16) *Elvira Gomez-Hernandez is the first Latina to hold a position (Regions Vice President) on the Executive Committee.*
- 17) *Jonathan Allen is the first openly gay man to hold a position (Secretary) on the Executive Committee.*

Discussion

The AAPG trails behind other large geoscience organizations, like GSA and AGU, in membership of women and diversity and inclusion efforts, programs, and frameworks (Fig. 9a-c). While the proportion of women in leadership roles and awards 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 GSA and AGU (Fig. 9b, c). AAPG women 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 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 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.

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). These provide useful focal points for organizations, including professional societies such as AAPG, to consider when developing processes and policies to uplift inclusion of minorities and diversify.

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). 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 and substantiates the perception that this is not one of the most esteemed of roles. This "service tax" often experienced by women throughout their career ultimately impedes attaining higher level awards, like the Sidney Powers Memorial 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). Women spending more time in such roles might be 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; Kotok, 2007).

Recommendations: Call to Action

The data in this study, and notable gaps in data collected, 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 diverse members, it is key that the broad membership of the association acknowledge 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 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 DEI efforts and programs. To facilitate future DEI efforts, AAPG needs to collect anonymous data that includes the option to select non-binary gender, race, ethnicity, and disability. It is recommended that questions about gender identity include options beyond “male”, “female”, and “transgender” (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 non-binary or transgender 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 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, racially, and ethnically balanced with respect to 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 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 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 their 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 has made significant strides in recent years to address the issue of gender imbalance of their fellowship, leadership, and grant and award winners. They have adopted a range of best practice measures to improve their nominations process and increase opportunities to recognize all scientists (we highly recommend looking at information provided at www.science.org.au). 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 determines 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 minority groups, 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.

Although AAPG has started to make 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 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 First Nations/Indigenous 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 recognize, embrace, and uplift historically under-represented populations and all other marginalized members by becoming more diverse and inclusive. This study provided 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 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 most uplift taking place in the past 10 years. AAPG women membership totals are lower than that of GSA and AGU, and AAPG awardees are consistently inequitable.

We recommend that race and gender diverse 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 representation at all organization 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 to 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), 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.

References

Allen, L., Rasmussen, M.L., Quinlivan, K., Aspin, C., Sanjakdar, F., Brömdal, A., 2014, Who's Afraid of Sex at School? The Politics of Researching Culture, Religion and Sexuality at School, *International Journal of Research and Method in Education* 37 (1): 31–43.

doi:<https://doi.org/10.1080/1743727X.2012.754006>

Ali, H.N., Sheffield, S.L., Bauer, J.E. et al., 2021, An actionable anti-racism plan for geoscience organizations, *Nature Communications* 12, 3794. <https://doi.org/10.1038/s41467-021-23936-w>

American Geophysical Union (AGU), 2018, AGU Diversity and Inclusion Strategic Plan, [AGU-Diversity-and-Inclusion-Strategic-Plan-2019.pdf](#)

Australian Academy of Science, 2020, Catalysing Gender Equity, Summary Report, [cge2020-summary-report.pdf \(science.org.au\)](#)

Australian Bureau of Statistics, 2018, Census of Population and Housing: Reflecting Australia - Stories from the Census, 2016. <https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/2071.0~2016~Main%20Features~Sex%20and%20Gender%20Diversity%20in%20the%202016%20Census~100>

Australian Bureau of Statistics, 2021, STEM-qualified occupations, Labour Force, Australia, Detailed, Quarterly Latest release, Detailed labour force data collected on a quarterly basis, Reference period: February 2020.

[STEM-qualified occupations | STEM Equity Monitor | Department of Industry, Science and Resources](#)

Baber, L.D., Pifer, M.J., Colbeck, C., Furman, T., 2010, Increasing Diversity in the Geosciences: Recruitment Programs and Student Self-Efficacy, *Journal of Geoscience Education*, 58:1, 32-42, DOI: 10.5408/1.3544292

Berhe, A.A., Barnes, R.T., Hastings, M.G. et al., 2022, Scientists from historically excluded groups face a hostile obstacle course. *Nat. Geosci.* **15**, 2–4, <https://doi.org/10.1038/s41561-021-00868-0>

Bernard and Cooperdock, 2018, No progress on diversity in 40 years, *Nature Geoscience*, 11, 292–295, www.nature.com/naturegeoscience

Block, T., 2012, Indigenous women and feminism: Politics, activism, culture. *BC Studies*, 174, 146–147.

Callahan, C.N., Libarkin, J.C., McCallum, C.M., Atchison, C.L., 2015, Using the Lens of Social Capital to Understand Diversity in the Earth System Sciences Workforce, *Journal of Geoscience Education*, 63:2, 98-104, DOI: 10.5408/15-083.1

Cech, E. A. & Blair-Loy, M., 2019, The changing career trajectories of new parents in STEM, *Proceedings of the National Academy of Sciences*, 116 (10) 4182-4187. <https://doi.org/10.1073/pnas.1810862116>

Ceci, S.J., Williams, W.M., Barnett, S.M., 2009, Women's Underrepresentation in Science: Sociocultural and Biological Considerations, *Psychological Bulletin*, American Psychological Association, Vol. 135, No. 2, 218–261.

Ceci, S. J., Ginther, D. K., Kahn, S., & Williams, W. M., 2014, Women in Academic Science: A Changing Landscape, *Psychological Science in the Public Interest*, 15(3), 75–141. <https://doi.org/10.1177/1529100614541236>

Crenshaw, K., 1989, Demarginalizing the Intersection of Race and Sex, *U. CHI. LEGAL F.* 139.

Crenshaw, K., 2018, Demarginalizing the intersection of race and sex: A Black feminist critique of antidiscrimination doctrine, feminist theory, and antiracist politics [1989]. In K. Bartlett & R. Kennedy (Eds.), *Feminist legal theory*, 57–80, New York: Routledge.

Donelson, R., and Rogers, T., 2004, Negotiating a Research Protocol for Studying School-based Gay and Lesbian Issues, *Theory Into Practice* 43 (2): 128–135.

Dutt, K., 2019, Race and racism in the geosciences. *Nature Geoscience*, 13(1), 2–3.

Dutt, K., Pfa, D. L., Bernstein, A. F., Dillard, J. S., & Block, C. J., 2016, Gender differences in recommendation letters for postdoctoral fellowships in geoscience, *Nature Geoscience*, 9(11), 805–808, <https://doi.org/10.1038/ngeo2819>

Eaton, A. A., Saunders, J. F., Jacobson, R. K., and West, K., 2020, How gender and race stereotypes impact the advancement of scholars in STEM: Professors' biased evaluations of physics and biology post-doctoral candidates, *Sex Roles*, 82, 127–141.

England, P., Levin, A., Mishel, E., 2020, Progress toward gender equality in the United States and slowed or stalled, *PNAS (Proceedings of the National Academy of Sciences of the United States of America)* 117 (13) 6990-6997, <https://doi.org/10.1073/pnas.1918891117>

Estrada, M., Hernandez, P.R., Schultz, P.W., Herrera J., 2018, A Longitudinal Study of How Quality Mentorship and Research Experience Integrate Underrepresented Minorities into STEM Careers, *CBE—Life Sciences Education*, Vol. 17, No. 1. <https://doi.org/10.1187/cbe.17-04-0066>

Fernandes, A.M., Abeyta, A., Mahon, R.C., Martindale, R., Bergmann, K.D., Jackson, C., Present, T.M., Reano, D., Swanson, T., Butler, K., Brisson, S., Johnson, C., Mohrig, D., 2020, Enriching Lives within Sedimentary Geology: Evaluating SEPM's Role in Diversity, Equity, and Inclusion, *EarthArXiv*, DOI: 10.31223/osf.io/y7v9e

Fouad N. A., Chang, W.H., Wan Min, S.R., 2017, Women's Reasons for Leaving the Engineering Field, *Frontiers in Psychology*, Vol. 8, 875. <https://www.frontiersin.org/article/10.3389/fpsyg.2017.00875>

Gonzales, L., 2019, Participation of women in the geoscience profession, *Geoscience Currents Data Brief* 15, American Geosciences Institute, 1–2.

Hagni, A. M., 1984, Stress and stress management among geoscientists in the U.S. petroleum industry, Master's Thesis, Missouri Science & Technology, 84 p.

Handley, H.K., Hillman, J., Finch, M., Ubide, T., Kachovich, S., McLaren, S., Petts, A., Purandare, J., Foote, A., Tiddy, C., 2020, In Australasia, gender is still on the agenda in geosciences, *Adv. Geosci.*, 53, 205–226, <https://doi.org/10.5194/adgeo-53-205-2020>

Hinchliffe, E., 2020, The number of female CEOs in the Fortune 500 hits an all-time record, *Fortune 500 and Catalyst*.

Hofstra, B., Kulkarni, V. V., Munoz-Najar Galveza, S., Heb, B., Jurafsky, D., McFarland, D. A., 2020, The diversity-innovation paradox in science. *Proc. Natl. Acad. Sci. U.S.A.* 117, 9284–9291.

Holmes, M.A. and O'Connell, S., 2003, Where Are the Women Geoscience Professors? *Papers in the Earth and Atmospheric Sciences*, 86, <https://digitalcommons.unl.edu/geosciencefacpub/86>

Holmes, M.A., O'Connell, S., Frey, C., Ongley, L., 2008, Gender imbalance in US geoscience academia, *Nature Geoscience*, Vol 1.

Holmes, M. A., O'Connell, S., and Dutt, K., 2015, *Women in the Geosciences: Practical, Positive Practices Toward Parity*, John Wiley, Hoboken, NJ.

Huang, J., Gates, A.J., Sinatra, R., Barabási, A.L., 2020, Historical comparison of gender inequality in scientific careers across countries and disciplines, *Proceedings of the National Academy of Sciences*, 117 (9) 4609-4616, DOI: 10.1073/pnas.1914221117

Huntington, K., Bear, T., Garziona, C., O'Connell, S., Rubin, J., Stout, N., Williams-Stroud, S., 2021, Report of the GSA Diversity Working Group to GSA Council, Spring 2021. Geological Society of America. <https://www.geosociety.org/documents/gsa/diversity/diversity-working-group-report-to-council-spring-2021.pdf> [diversity Working Group to GSA Council, Spring 2021 \(geosociety.org\)](https://www.geosociety.org)

Jackson, C.A.L., 2017, Recognizing and Rewarding Excellence Without Blinkers – A Close-to-Home Case Study. American Association of Petroleum Geologists International Conference & Exhibition London, Abstracts.

Jones, C., Fraser, J., Zhang, D., 2021, Racial justice in the workplace: In-depth look at diversity's struggle to crack corporate boardrooms, USA Today, <https://www.usatoday.com/in-depth/money/business/2021/07/18/workplace-diversity-struggles-break-into-corporate-boardrooms/7906529002/>

Jones, T., Coll, L., van Leent, L., and Taylor, Y., 2019, *Uplifting Gender and Sexuality Education Research*. London: Palgrave Macmillan.

Kotok, A., 2007, Depression in the Scientific and Technical Workforce, Science, <https://blogs.sciencemag.org/sciencecareers/2007/10/depression-in-t.html>

Levine, A., 2020, Progress toward gender equality in the United States has slowed or stalled. Retrieved from osf.io/kx94e

Lincoln, A.E., Pincus, S., Koster, J.B., Leboy, P.S., 2012, The Matilda Effect in science: Awards and prizes in the US, 1990s and 2000s, *Social Studies of Science*, 1–14, DOI: 10.1177/0306312711435830

Lerback, J. and Hanson, B., 2017, Journals invite too few women to referee, *Nature*, DOI: 10.1038/541455a

Maughan, L., Natalier, K., Mulholland, M., 2022, Institutional transphobia: barriers to transgender research in early years education, *Gender, and Education*, DOI: [10.1080/09540253.2022.2057930](https://doi.org/10.1080/09540253.2022.2057930)

Malcom, S.M., Hall, P. Q., Brown, J.W., 1976, The Double Bind: The Price of Being a Minority Woman in Science, American Association for the Advancement of Science, AAAS Report No. 76-R-3.

Matsuno, E. & Budge, S. L., 2017, Non-binary/genderqueer identities: A critical review of the literature, *Curr. Sex. Health Rep.* 9, 116–120.

Marín-Spiotta, E., Barnes, R. T., Berhe, A. A., Hastings, M. G., Mattheis, A., Schneider, B., and Williams, B. M., 2020, Hostile climates are barriers to diversifying the geosciences, *Advances in Geosciences*, 53, 117–127, <https://doi.org/10.5194/adgeo-53-117-2020>

Newton, A., 2012, Plugging the leaks, *Nature Geoscience*, Vol. 5, 522.

O'Sullivan, S., 2019, First Nations' women in the academy: disrupting and displacing the white male gaze. In G. Crimmins (Ed.), *Strategies for resisting sexism in the academy: higher education, gender, and intersectionality* (pp. 115-127). (Palgrave Studies in Gender and Education). Palgrave Macmillan.

Patterson, L., Kirschke, A., Seaton, P., and Hossfeld, L., 2016, Challenges for Women Department Chairs, Academic Chairpersons Conference Proceedings, <https://newprairiepress.org/accp/2016/Trends/2>

Pico, T., Bierman, P., Richardson, S., & Doyle, K., 2020, First authorship gender gap in the geosciences, <https://doi.org/10.1002/essoar.10502505.1>

Popp, A. L., Lutz, S. R., Khatami, S., van Emmerik, T., & Knoben, W. J. M., 2019, A global survey on the perceptions and impacts of gender inequality in the Earth and space sciences, *Earth and Space Science*, 6, 1460–1468, <https://doi.org/10.1029/2019EA000706>

Ranganathan, M., Lalk, E., Freese, L. M., Freilich, M. A., Wilcots, J., Duffy, M. L., & Shivamoggi, R., 2021, Trends in the representation of women among US geoscience faculty from 1999 to 2020: The long road toward gender parity, *AGU Advances*, 2, e2021AV000436, <https://doi.org/10.1029/2021AV000436>

Rawlings, V., 2018, They'll Never Let You Do That! The Reality of Researching Gendered Violence in NSW Schools, In *Gender and Education Association Conference 2018*, Newcastle.

Ryan, C. L., and Hermann-Wilmarth, J.M., 2019, Heteronormative Gatekeeping When Enacting Queer Research in Elementary Schools: An Autoethnographic Perspective, *Journal of Lesbian Studies* 24 (4): 1–17, DOI:<https://doi.org/10.1080/10894160.2019.1676567>

Spizzirri, G., Eufrásio, R., Lima, M.C.P. et al., 2021, Proportion of people identified as transgender and non-binary gender in Brazil, *Sci Rep* 11, 2240, <https://doi.org/10.1038/s41598-021-81411-4>

Stokes, P.J., Levine, R., Flessa, K.W., 2015, Choosing the Geoscience Major: Important Factors, Race/Ethnicity, and Gender, *Journal of Geoscience Education*, 63:3, 250-263, DOI: 10.5408/14-038.1

Suzack, C., Huhndorf, S. M., Perreault, J., & Barman, J. (Eds.), 2010, Indigenous women and feminism: Politics, activism, culture. Vancouver: University of British Columbia Press.

U.S. Department of Education, 2017, National Center for Education Statistics, Integrated Postsecondary Education Data System,
<https://nces.ed.gov/surveys/SurveyGroups.asp?group=2>

White, K.S., 2021, GSA Position Statement Diversity in the Geosciences, The Geological Society of America, [Diversity in the Geosciences \(geosociety.org\)](https://www.geosociety.org)

Williams, C.L., Muller, C., Kilanski, K., 2012, Gendered Organizations in the New Economy, *Gender & Society*; 26(4):549-573, DOI:10.1177/0891243212445466

Williams, B. M., McEntee, C., Hanson, B., and Townsend, R., 2017, The Role for a large scientific society in addressing harassment and work climate issues, *Annals of Geophysics*, 60, 7, <https://doi.org/10.4401/ag-7441>

Williams, C. L., 2021, *Gaslighted: How the Oil and Gas Industry Shortchanges Women Scientists*, University of California Press, ISBN: 9780520385283

Witze, A., 2016, Gender bias found in Earth-science society journals, *Nature*, DOI:10.1038/nature.2016.20708



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