

1 ***Creating and Promoting Gender Equity and Diversity***
2 ***in Professional Geological Societies***
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4 Kernen, R.¹, Abu, C.², Allen, J.³, Ahmed, S.⁴, Avary, K. L.⁵, Birgenheier, L.⁶, George,
5 T.⁷, Gomez, K.⁸, López Vega, A.⁹, Onwumelu, C.¹⁰, Rysak, B.⁸, Hart-Wagoner, N¹¹
6

7 ¹University of Adelaide, Australian School of Petroleum & Energy Resources,
8 rachelle.kernen@adelaide.edu.au, Twitter: @sed_salt_belle
9

10 ²Schlumberger, CAbu@slb.com, Twitter: @clararocks3
11

12 ³Chevron, jonathan.allen@chevron.com, Twitter: @therockdoctor_
13

14 ⁴Texas A&M, College Station, sumiyah@gmail.com, Twitter: @geogen2020
15

16 ⁵Avary Geoscience, avarygeo@gmail.com
17

18 ⁶The University of Utah, Geology and Geophysics Department,
19 lauren.birgenheier@utah.edu, Twitter: @gloriouslymuddy
20

21 ⁷EOG Resources, terra_george@eogresources.com
22

23 ⁸The University of Texas at Austin, Department of Geological Sciences,
24 kiaragomez@utexas.edu, Twitter: @KiaraJGomez1
25 bethany.rysak@utexas.edu
26

27 ⁹Total, andrea.lopez@total.com
28

29 ¹⁰The University of North Dakota, Harold Hamm School of Geology and Geological
30 Engineering, chioma.onwumelu@und.edu, Twitter: @c_h_i_o_m_a
31

32 ¹¹Unaffiliated, hartnic4@gmail.com, Twitter: @hartnic4
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46 **Abstract**

47 Diversity drives innovation. When professional organizations allow gender
48 inequity to persist, they continually lose talented, valuable individuals who drive
49 economic growth and profits. According to membership data collected by the American
50 Association of Petroleum Geologists (AAPG), American Geophysical Union (AGU), and
51 the Geological Society of America (GSA) there is evidence of continued gender inequity
52 in professional geological societies, particularly, in the AAPG. Specifically, there are
53 remaining inequities in the percentage of women holding leadership and technical
54 positions, publishing articles, giving distinguished lectures, and receiving technical and
55 service awards within AAPG, even when compared to the proportional percentage of
56 AAPG members. Because the AAPG is a major international geoscience professional
57 organization, this inequity greatly contributes to the gender and diversity disparity that
58 we see today in the greater geoscience community. The recent compilation and
59 comparison of historical AAPG award and leadership role data allow for an opportunity
60 to provide solutions to advance gender equity and give meaningful power to diversity in
61 AAPG’s most visible and prestigious opportunities. By addressing this issue and
62 implementing meaningful measures to improve gender equity, professional societies
63 such as AAPG, can demonstrate tangible efforts to eliminate the discrimination, bias,
64 and barriers many women encounter and support women in having equitable
65 opportunities as professional geoscientists.

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76 **Introduction**

77 In the last decade, there have been significant efforts to recruit greater numbers
78 of women into science-technology-engineering-math (STEM) fields, spanning pre-K
79 through undergraduate education. Geoscience enrollment and degree trends indicate
80 these efforts have been generally successful. From 2010-2017, data published by the
81 American Geosciences Institute (AGI; Gonzales, 2019) indicates that enrollment and
82 graduation rates of women with B.S., M.S., and Ph.D. degrees in geological sciences
83 have remained steady between roughly 35-45% as compared to roughly 20-25% in
84 1985. With continued recruiting efforts, it is hoped the percent of women with
85 geoscience degrees will rise to an even more equitable level.

86 Despite relatively successful recruiting efforts, current data indicate significant
87 inequity persists in the gender distribution of professionally employed geoscientists.
88 During the same period as above (2010-2017), data from the National Science
89 Foundation (NSF) and AGI indicate that the percentage of women with geoscience
90 degrees working as geoscientists decreased from 17% to 11%. While historically high
91 percentages of women earn geoscience degrees, those percentages crumble to roughly
92 half of women employed as professional geoscientists compared to their male
93 counterparts (Gonzales, 2019). These statistics were also compared with the American
94 Association of Petroleum Geologists (AAPG) membership data which indicate that
95 women membership has hovered between 19-21% since 2014 and prior to that, it was
96 significantly less (<18%).

97 Historically, gender inequality has been linked to a lack of visible role models and
98 workforce retention issues (Gonzales, 2019; Newton, 2012, Popp et al., 2019). Low
99 retention can result in a “leaky pipeline” where not nearly as many candidates who enter
100 the profession in college obtain a job in the geosciences (Holmes et al., 2008). Further
101 attrition occurs as many women leave the workplace at higher rates than men
102 throughout their careers (Fouad et al. 2017; Cech and Blair-Loy, 2019). Several studies
103 have identified factors that contribute to leaks in the pipeline, which include a lack of
104 visible sponsors; limited mentors and advisors; emotionally unsupportive classroom and
105 work environments; gender-based isolation and discrimination; biased or nepotistic

106 hiring and lay-off practices; ‘family-unfriendly’ policies; poor marketing of geoscience
107 programs to minorities and women; a difference in career goals between men and
108 women; and low self-confidence and self-efficacy among women and minority
109 geoscientists (Baber et al., 2018; Callahan et al., 2015; Ceci et al., 2011; Estrada et al.,
110 2018; Holmes et al., 2008; Holmes and O’Connell, 2003; Stokes et al., 2015; Williams,
111 2012; Williams, 2017).

112 These inequities are not only observed in the workforce but also in professional
113 organizations. Visible women in prestigious geoscience leadership positions, awards,
114 publications, distinguished lectures, and technical roles are underrepresented relative to
115 men and relative to the total percentage of women scientists within geoscience
116 professional society membership (Lincoln et al., 2012; Holmes et al., 2015; Fernandes
117 et al., 2020). Women of color are rarely nominated or selected for these positions and
118 awards, falling into “the double bind” or “double jeopardy” phenomena (Malcom et al.,
119 1975; Ceci et al., 2014). Recent data clearly indicate that the ongoing impact of implicit
120 and explicit bias on women’s careers is real and significant (Eaton et al., 2020; Huang
121 et al., 2020) and is even more detrimental for women of color (Dutt, 2019). Implicit and
122 explicit bias over the length of a woman’s career severely limits the diversity of the
123 candidate pool for prestigious leadership positions, technical and service awards,
124 publications, distinguished lectures, and technical roles within geologic societies further
125 causing gender inequality. Systemic inequities leave women constantly “swimming
126 upstream” or “working against a headwind” which leads to less wealth, burn out, and
127 systemic mental and physical health issues (Hagni, 1985; Kotok, 2007).

128 AAPG is an internationally leading professional geoscience society, with strong
129 ties to the private energy industry workforce. Because the energy industry is a major
130 employer of professional geoscientists, many geoscience professionals globally rely on
131 the AAPG for networking, training, and professional opportunities. Since it plays a
132 major role in the geoscience workforce landscape, examining metrics of gender equity
133 within AAPG is critical to continued efforts to diversify the workforce and, hence,
134 innovation. Women within AAPG are more likely to be nominated and elected to service
135 roles (such as ‘Secretary’); ultimately the time working in service roles taxes their

136 careers and hinders them from being as competitive for more prestigious technical roles
137 and awards and submitting first-author papers for publication (Witze, 2016; Lerback &
138 Hanson, 2017; Pico et al., 2020). Furthermore, other major geoscience professional
139 organizations have completed studies examining the internal gender balance of key
140 roles (e.g., Fernandes et al., 2020), but a similar self-introspective study of AAPG is
141 lacking.

142 The goals of this study are to 1) utilize available data from AAPG to evaluate the
143 percentage of women who have held leadership or technical roles, won technical or
144 service awards, published papers in society journals, or held distinguished lecturer
145 positions within AAPG, 2) compare data to related geoscience professional
146 organizations like GSA and AGU, and 3) provide recommendations for future initiatives
147 based on the results of the data analysis and documented literature.

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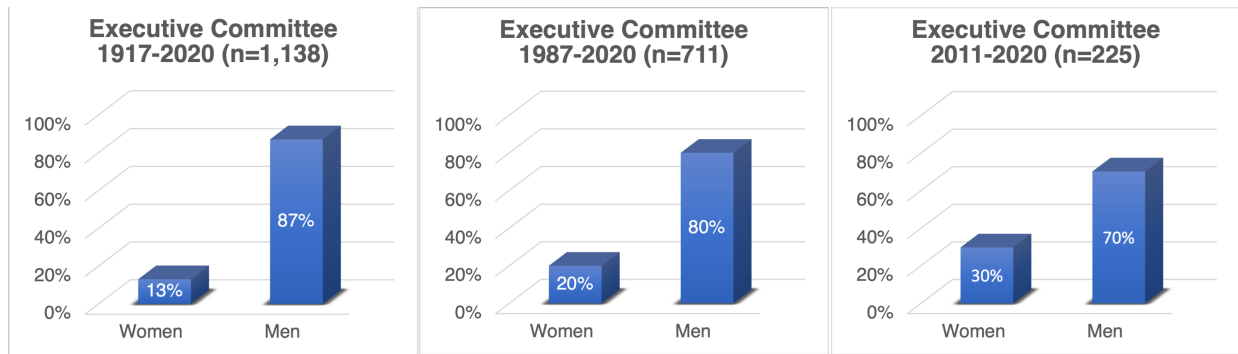
166 **Data Analysis**

167 Data recording the gender distribution utilized in this study were compiled from
168 annual reports within each respective organization. Data presented in this study have
169 been compiled in collaboration through personal knowledge and public website
170 information and represent the authors' perception of gender identity rather than an
171 individual's own self-reported identity. Currently, the only demographic data that AAPG
172 collects are age and gender (binary), whereas race, ethnicity, disability status, and
173 sexual orientation are not collected. This analysis is therefore incomplete and more
174 robust data collection is needed for a thorough analysis.

175 *AAPG Leadership*

176 Since 1917 there have been 1,138 executive committee leadership positions
177 within AAPG and its divisions (Division of Professional Affairs-DPA; Division of
178 Environmental Geoscientists-DEG; Energy & Minerals Division-EMD). A total of 145
179 women (13%) have held leadership positions since the first woman was elected in 1987
180 (Fig. 1). Since that time, women have held leadership positions every year except for
181 1994, with the percent of men to women ranging from 1.8 to 21 (5.5 average). The
182 percentage of women in leadership has been increasing overall and since 1987, the
183 percentage of women in AAPG leadership is higher than the percentage of women
184 members for 31 out of the 34 years. 2020 marks the largest number of women in
185 leadership, with women holding 10 (46%) of the 22 positions. Over the last 10 years
186 (2011-2020), Secretary and Editor are the positions women are most often held by
187 women, with the position of Secretary being the only position where women have held
188 office more than men.

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Figure 1: The number of men versus women in AAPG's Executive Leadership Committee from 1917-2020, 1987-2020, and 2011-2020.

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194 **AAPG Awardees**

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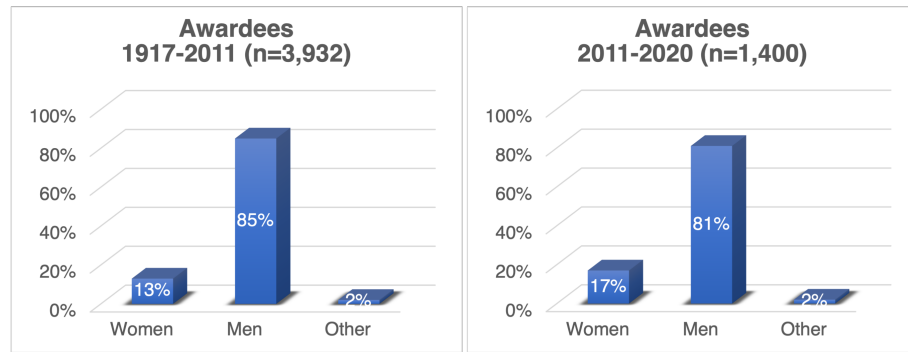
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Women's service to the AAPG Executive Committee outweighs female award rates. Since 1917, there have been 3,932 awards granted by the association, including the AAPG Foundation. A total of 3,348 (85%) awards have been received by men and 497 (13%) have been received by women (Fig. 2). If the number of awardees whose sex is unknown (largely due to gender uncertain names, e.g., R.D. Smith) were included as women awardees, this number would increase to 584 (15%). Almost half (49%) of all awards that have recognized women were received in the last decade.

The first award that was received by a woman was granted in 1963 (Dollie Radler Hall; Honorary Member). Since 1975, at least one award was presented to a woman awardee every year. In 2017, 30 (22%) women received awards, which was the largest number of women recognized in a single year. Over the last 10 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. 3). A woman has never received AAPG's highest honor, the Sidney Powers Memorial Award. The percentage of women recognized by AAPG awards has been higher than the percentage of women members for only 3 of the last 10 years. This is in dramatic contrast to the percentage of women in leadership positions, which has been greater than the percentage of women members every year of the last decade.

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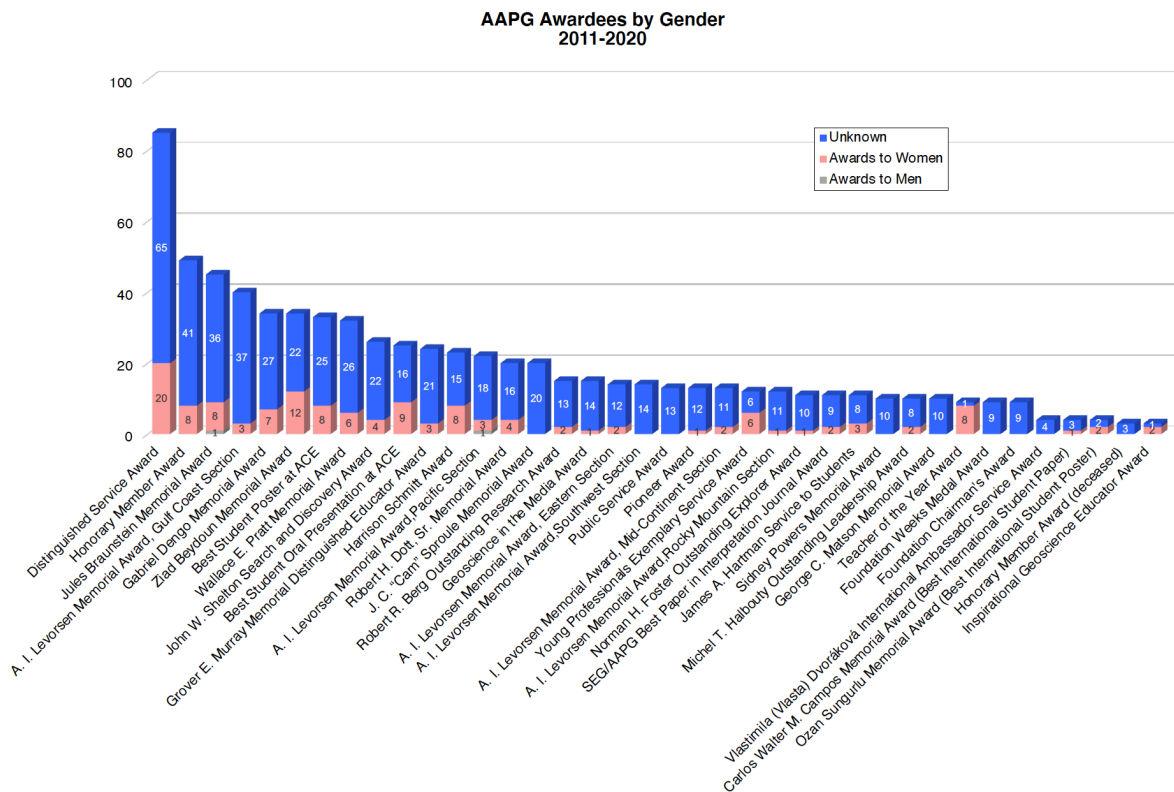
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Figure 2: The number of men versus women (including unknown and other genders)

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AAPG awardees from 1917-2020 and 2011-2020.



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Figure 3: The number of men versus women (including unknown and other genders)

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AAPG awardees divided by award name.

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AAPG Publications, Distinguished Lecturers, & Technical Roles

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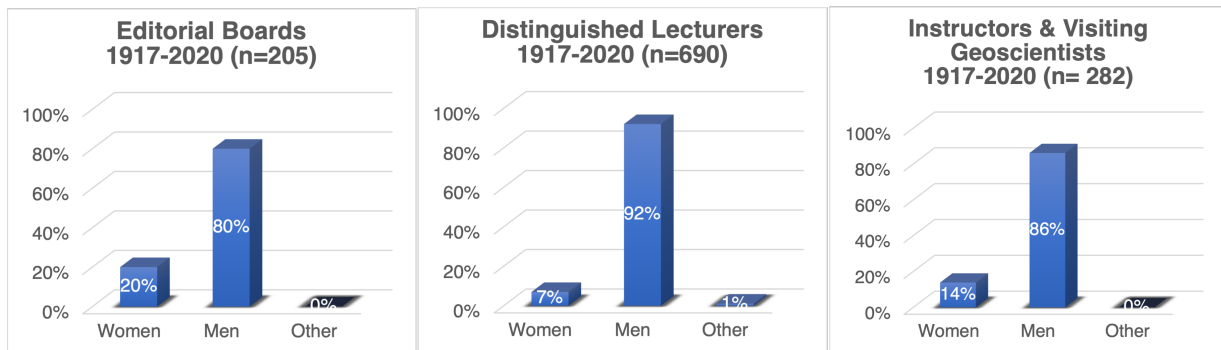
The previous and current editorial teams for AAPG's publications lack diversity and equity. Editorial teams for the AAPG Bulletin include 28 men (72%) and 11 women

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225 (28%), Environmental Geoscience includes 22 men (73%) and 8 women (27%),
 226 Interpretation includes 30 men (86%) and 5 women (14%), and the last 10 years of
 227 AAPG Special Publications includes 85 men (84%) and 16 women (16%). Since 1961,
 228 there have been 690 Distinguished Lecturers with just 48 (7%) women (Fig. 4). The first
 229 woman Distinguished Lecturer served in 1982. Over the last decade, the percentage of
 230 women Distinguished Lecturers has increased to 20% but within a given year this is
 231 highly variable, ranging from 9% to 67%.

232 AAPG lists instructors available for lectures and short courses on the
 233 organization’s website, and therefore represents the most visible venue to examine the
 234 diversity of the instructor pool. Of the 130 instructors listed, only 12 (9%) are women.
 235 Additionally, members who have volunteered to give short presentations to colleges and
 236 universities, known as Visiting Geoscientists, are also available on the AAPG website.
 237 Of the 152 Visiting Geoscientists, 27 (18%) are women. Both of these percentages are
 238 lower than the current percentage of women AAPG members (21%).

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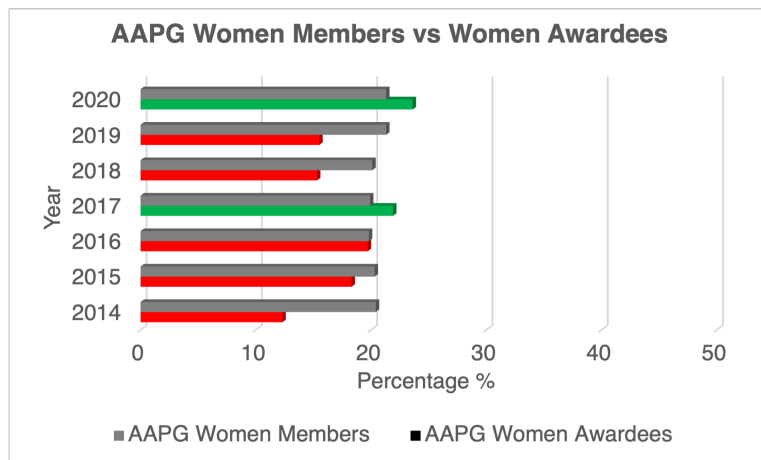
241 *Figure 4: The number of men versus women (including unknown and other genders) to*
 242 *serve on editorial boards, and as distinguished lecturers, and instructors (Technical*
 243 *Positions).*

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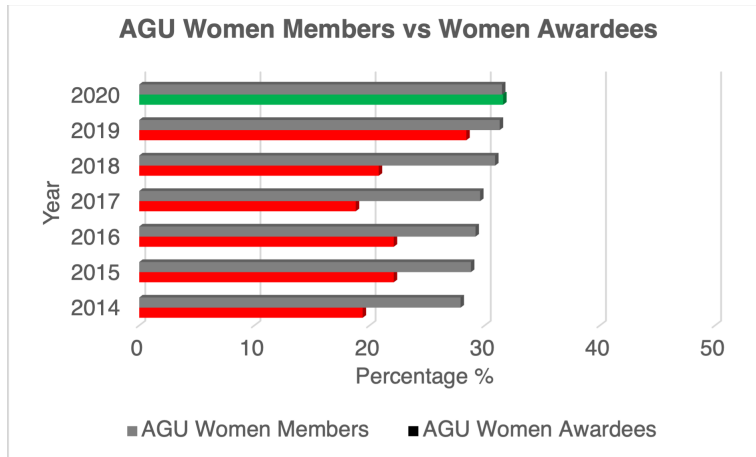
245 *Comparison to Other Geologic Organizations*

246 AAPG was compared with two other geologic organizations where both awardee
 247 and membership data were either readily available or provided (Fig. 5). In comparison
 248 with the Geological Society of America (GSA) and the American Geophysical Union

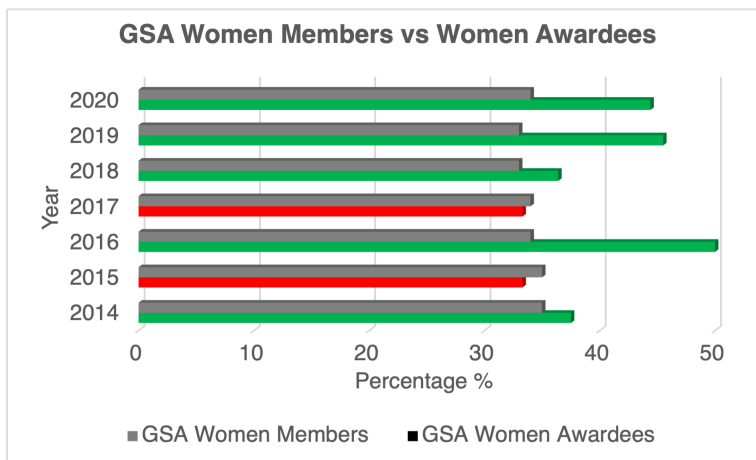
249 (AGU), AAPG awardees are not representative of the AAPG membership and are the
250 least representative of the three organizations. Please note that AGU's women
251 awardees are only AGU Fellows. AGU has numerous awards, medals, and prizes, both
252 at the Union level and at the section levels (i.e., subgroups based on scientific
253 disciplines). The AGU Fellow was used because it is undeniably one of the highest
254 honors bestowed by AGU and is the largest group of honorees and is the most
255 consistent dataset going back to the 1960's. A striking observation is that the
256 percentage of AAPG women members is significantly less than the women members of
257 both GSA and AGU. Not only does AAPG lack equitable representation of women in
258 leadership, awards, and technical positions, the organization also struggles attracting
259 women members as compared to other professional geologic societies.
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265 *Figure 5: The percentage of women awardees compared to the overall percentage of*
 266 *women members. Red indicates years when women were underrepresented relative to*
 267 *the membership percentages, while green indicates years when women were*
 268 *appropriately represented.*

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277 **Call to Action**

278 AAPG needs to increase representation of all under-represented groups by
279 supporting the AAPG Women's Network Special Interest Group (SIG) to elevate it's
280 status by become a Division and to support all initiatives put forth by the STEMulating
281 Diversity SIG. Although some professional geological societies are trending toward
282 gender equity, there are still many initiatives geological societies can implement to
283 increase women membership and representation. While these recommendations are
284 specific to AAPG, many of these initiatives can and should be implemented within other
285 professional societies.

286 In order to increase women membership and participation, it is imperative AAPG
287 takes significant steps to eliminate sexual harassment, discrimination, and
288 microaggressions related to AAPG participation and activity. To ensure a high standard
289 of professional behavior, programs supporting justice, equity, diversity, and inclusion
290 (JEDI) need to be implemented and participation is a requirement for all staff and
291 volunteers. AAPG lags behind other large geoscience organizations, like GSA and
292 AGU, in JEDI efforts, programs and framework (Fig. 5). Women need to be
293 appropriately represented at all levels within the organization and, at a minimum, match
294 the percentage of women membership.

295 The authors recommend that AAPG collect member demographic data (within
296 the confines of local privacy laws) in order to establish metrics in which to benchmark
297 JEDI efforts and programs. In order to facilitate future JEDI efforts AAPG needs to
298 collect data based on the gender spectrum (two spirit, transgender women, transgender
299 man, questioning, pangender, non-binary, intersex, gender nonconforming, gender fluid,
300 genderqueer, Cis woman, Cis man, agender) race, ethnic background, and disabilities
301 such as physical, communication (hearing, speech, color blindness), intellectual and
302 emotional (autism, bipolar). These results need to be published yearly (anonymously)
303 to ensure transparency and appropriate solutions. At a minimum and at all levels,
304 AAPG needs to be gender, racial, and ethnically balanced with respect to AAPG's
305 overall membership statistics. To address inappropriate and unprofessional behaviors, a
306 confidential protocol (through the Code of Ethics) needs to be implemented in order to

307 report JEDI violations and abuse. Such a protocol would ensure violations are handled
308 professionally and with the appropriate consequences to ensure no emotional or
309 professional ‘backlash’ or ‘blacklisting’ to the victim(s). Appropriate and fit-for-purpose
310 disciplinary action needs to swiftly take place in order to build trust within the
311 membership.

312 In addition to JEDI policies and procedures, women need to be nominated for
313 AAPG awards and positions by their peers in significantly higher numbers. In order to
314 work towards addressing this issue, the AAPG Women’s Network has established a
315 committee to oversee women’s resumes, AAPG activity, and service records in an
316 evergreen database so applications can be tracked and easily submitted for award and
317 position nominations. The procedures that AAPG uses to determine the recipients of
318 AAPG awards and positions need to be transparent and publicly available to ensure
319 JEDI policies and procedures are being honored and enforced. It’s absolutely vital that
320 the women of AAPG embrace and closely work alongside the men who advocate for
321 them (ALLY) within the organization.

322 AAPG is failing its women membership and it is perpetuating gender inequity that
323 results in the loss of incredible talent in the energy industry (Fig. 5). Representation and
324 equity go far beyond ‘awarding an equitable number of women awardees and leaders to
325 the percentage of membership’. Pigeonholing women in service, support, and teaching
326 roles instead of leadership positions ultimately hinders them from being competitive for
327 more prestigious technical roles, awards, and submitting first-author papers for
328 publication (Witze, 2016; Lerback & Hanson, 2017; Pico et al., 2020). Because women
329 are less competitive due to their extensive service, support, and teaching roles, they
330 never actually make it to the highest levels of leadership among professional societies,
331 academic institutions, or C-Suite industry positions. Professional geologic organizations
332 should not take their role in influencing the membership’s careers lightly; a higher
333 standard of overall equity, conduct, and eliminating sexual harassment needs to be
334 resolved for the profitability of the organization and the well-being of its membership
335 (Marín-Spiotta et al., 2020).

336 To further increase participation and membership across all levels, a cultural
337 transformation is greatly needed within AAPG to support gender equity. AAPG must
338 include under-represented minority members and students within conversations,
339 leadership positions, award nominations, as they will be the next generation of leaders.
340 We can tackle the issue of increasing minority membership by actively seeking out
341 female minority students and professionals to be more involved, as well as including
342 them in decision-making conversations and highlighting their achievements. Within the
343 female minority group, there are first-generation students who are often lost in
344 navigating the AAPG community due to lack of mentoring and sponsorship. AAPG
345 should include minorities and consider appropriate practices for recruiting and retaining
346 a diverse population.

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348 **Conclusions**

349 In order for the AAPG and other professional geological societies to be financially
350 successful and technically innovative in the future, they need to embrace and uplift
351 female and minority populations (and all other marginalized members) by becoming
352 more diverse and inclusive. We provided a base framework of demographic data
353 needed to analyze gender equity and diversity across all professional societies and
354 organizations. Specifically, race and gender data need to be collected and published
355 publicly for members of AAPG to view and to provide a reference point for future
356 assessments of JEDI. We provide evidence that highlights how and why JEDI is
357 important and highly encourage a cultural shift to take place within the greater AAPG
358 organization. We recommend that the AAPG reports and handles all types of
359 harassment and bullying, with increasing women's roles at all levels of the organization
360 (from session chairs, to Distinguished Lecturers, and leadership). By supporting the
361 Women's Network Division and STEMulating Diversity SIG, it will allow JEDI practices
362 to have greater influence over the AAPG community, however it is not the sole
363 responsibility of those networks. It is important for each member, leader, and staff
364 member of the AAPG to be informed about the gender, racial, and ethnic inequities and
365 to embrace the AAPG community by not only improving the statistics but improving the

366 overall experience of AAPG communications and activities. Our hope is that the AAPG
367 will embrace the Women’s Network and STEMulating Diversity in order to provide
368 structure and support to the rest of the organization and implement the processes
369 required for a culture shift to take place.

370 Not only do women and minorities need to be recognized at all levels of the
371 organization in equal proportions (from session chairs, to Distinguished Lecturers, and
372 leadership), but cultural bias including the expectation that women and minorities do the
373 majority of ‘service work’ needs to change. Women and minorities need to be
374 nominated for many more technical roles, awards, and submit first-author papers for
375 publication in the AAPG Bulletin. Additionally, early and mid-career scholarships
376 targeting a diverse set of recipients need to be established in order to help solve the
377 systemic disadvantages that women and minorities face in the energy geosciences.

378 *“If you want to be a true professional, do something outside yourself.”*

379 Ruth Bader Ginsburg

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391 sociology literature for the appropriate background research to take place.

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