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State of the art on gender equality at the Geological Survey of Italy

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Abstract

This study investigates gender distribution in different roles and positions within the Department for the Geological Survey of Italy (GEO) and compared with other European Geological Surveys (EGS) and Italian geologists. A specific focus is dedicated to fieldwork, an activity traditionally perceived as male dominated. Through the analysis of employment data from 2010 to today, survey results, and European reports, the concentration of women and men in different occupations (horizontal segregation) and the uneven distribution of genders in leadership positions (vertical segregation) are assessed. Despite a slight increase in the number of female leaders in recent years, women remain underrepresented in technical staff roles at GEO, with percentages stalling around 40%, consistent with broader European trends. The study also highlights a persistent gendered division in private workload: women are more likely to take parental leave, care for relatives, and devote free time to unpaid care work. Initiatives introduced at GEO, such as agile work and support during maternity leave periods, have improved life-work balance, although long-term effects require further evaluation. Additionally, the research points out the invisibility of gender variability in official statistics: we argue this constitutes a specific type of segregation and propose a non-binary approach to data collection. Addressing all types of segregation requires targeted actions, including systematic, necessarily participatory, collection of gender-disaggregated data on both public and private workload, and promotion of positive workplace practices. This approach would help reduce gender gaps and foster a better working environment for all employees, regardless of gender.

Keywords: Women geologists, Geological field survey, Segregation, Private workload, Gender equality.

1. Introduction

The underrepresentation of women in STEM disciplines (i.e., Science, Technology, Engineering, and Mathematics) is well documented. The most recent "She Figures" report by the European Commission highlights that there have been no significant changes in recent years, with women remaining underrepresented at all levels (from students to employees) and their presence decreasing progressively as they move up the career ladder (European Commission, 2025).

Within the STEM disciplines, geosciences are closely associated with fieldwork or job-related activities outside the home institution (or office). These activities often involve travel of varying durations, long working days away from personal support networks, physically demanding tasks, exposure to harsh environmental conditions and potential risks, or extended periods living on oceanic vessels.

Some of these activities are socially perceived as less suitable for the female staff, while others tend to favour the involvement of that segment of the workforce with fewer socially expected care responsibilities.

In Italy, the few studies and reports on gender disparity in geosciences have focused primarily on the academic and research sectors (e.g., Agnini et al., 2020; Comitato Unico di Garanzia – Istituto Nazionale di Geofisica e Vulcanologia – CUG-INGV, 2020; Istituto Nazionale di Oceanografia e di Geofisica Sperimentale – OGS, 2022; Istituto Superiore per la Protezione e la Ricerca Ambientale – ISPRA, 2025), due to the relative ease of identifying categories and accessing homogeneous and up-to-date data. However, systematic and comprehensive data collection is still lacking, preventing a full understanding of broader trends in the job market and, more specifically, in the research institutions involved in geology. Moreover, data on geoscientists' private workload remain scarce, and little is known about imbalance in caring responsibilities.

The authors of this work are all women and geologists, working at the Department for the Geological Survey of Italy (GEO): we are part of a specific office, GEO-CAR, whose institutional tasks include frequent geological surveys aimed at producing geological maps, both onshore and offshore. The identification of specific challenges that appeared to affect women more than men led us to investigate and understand whether the characteristics of our job act as a barrier for women entering and remaining in this profession.

We also sought data that could help quantify where we are in both time and space – that is, to reconstruct the history of gender balance of geoscientists working at GEO – and to assess how these numbers compare to similar institutions in Italy.

An additional outcome of our research is the recognition of a specific form of gender discrimination towards those people who do not recognize themselves in a binary classification: invisibility.

Gender Equality is a goal of Agenda 2030, and all private and public institutions are expected to contribute to its achievement. This work provides a snapshot on the current state of Gender Equality at GEO, outlining the measures already implemented and identifying what remains to be done to meet the targets of the 5th Sustainable Development Goal of the Agenda 2030, with particular focuses on targets 5.4 – "Recognize and value unpaid care and domestic work (…)" and 5.5 – "Ensure women's full and effective participation and equal opportunities for leadership at all levels (…)" (United Nations, 2025).

2. Data, data issues and lexical notes

For our research, we used different sources and types of data. These data have been collected for different purposes and aggregated in different ways, and therefore they are not necessarily homogeneous and comparable. All the data and the related sources used are listed in Table 1. The first issue encountered when addressing gender disparity in geosciences has been the shortage of systematic and comprehensive data; indeed, the lack of data, or their partiality, constitutes a problem itself (Criado Perez, 2019; Columbro, 2024). "Three Years Positive Actions Plans" (Gazzetta Ufficiale, 2006; d.lgs.198/06) and "Gender Equality Plans" (European Commission, 2021), documents published by several Institutions, are available data sources, although they rarely contain data useful to unravel possible horizontal segregation (i.e., the concentration of women and men in different sectors and occupations according to the European Institute for Gender Equality – EIGE, 2025) as, for example, the different duties carried out by women and men. Furthermore, it is often difficult to discern if data are disaggregated by sex or by gender. It is useful to recall here that "sex" refers to biological characteristics (i.e., female, male, intersex, European Commission, 2020b) and "gender" refers to sociocultural attitudes, behaviors, and identities (European Commission, 2020b); individuals may therefore self-identify themselves in many different ways. As observed by Schredl et al. (2025), "quantitative gender-related measurements tend to conflate the concepts of sex and gender". This is evident, for example, when a dataset refers to gender, but data-categories refer to sex (e.g., if a graph title is "Gender distribution" and the categories are "female" and "male"). Conflation of terms in the field of data collection dates to 1995: in the document which first indicated as an "Action to be taken" the collection of data "disaggregated by, among other factors, sex and age" the terms "sex" and "gender" have been used interchangeably (United Nations, 1995). More recent documents consider only "women" and "men" as gender categories (European Commission, 2020a; 2021), even though the differences between "sex",

Years	Type	Source	Notes
		EuroGeo Surveys	
2010	Gender-binary distribution of the technical staff in 12 of the 33 EGS Countries	Pichezzi et al., 2013	
From 2017 to 2022	Gender-binary distribution of employees in a scientific permanent position working at the Geological Surveys members of EGS	EGS annual/bi-annual reports https://eurogeosurveys.org/resources/publications/	2017-2020 data can be found, as they are, in the EGS annual/bi-annual reports, whereas data for the years 2021 and 2022 have been calculated using percentages and information present in those reports. Accessed 31/03/25
2022	Gender distribution of the total number of staff (sum of scientific permanent, other permanent and temporary staffs)	EGS bi-annual report https://eurogeosurveys.org/wp-content/uploads/2023/10/Statistic_Bi-Annual-report-EGS_2023.pdf	Accessed 31/03/25
2020 and 2024	Gender-binary distribution of Directors, National Delegates and Project Leaders of the National Surveys at EGS	EGS website https://eurogeosurveys.org/research/	Accessed 31/03/26
		Female geologists in Italy	
2018-2023	Gender-binary distribution of students graduated in Geological Sciences	ALMALAUREA website https://www2.almalaurea.it/cgi-asp/classi/Scheda.aspx?codiceAggr=10016&tipoCorso=L&lang=it and https://www2.almalaurea.it/cgi-asp/classi/Scheda.aspx?codiceAggr=11086&tipoCorso=LS&lang=it	Accessed 31/03/25
2023	Gender-binary distribution of the employees	Gender-balance Report of the Italian Institute for Environmental Protection and Research (ISPRA) https://www.isprambiente.gov.it/it/pubblicazioni/documenti-tecnici/bilancio-di-genere-ispra-2023-dati-e-informazioni-2022	Accessed 31/03/25
2020	Gender-binary distribution of the employees	Three-Year Positive Action Plan 2020-2022 for the Italian National Institute of Geophysics and Volcanology (INGV) https://istituto.ingv.it/images/cug/Piano_Azioni_Positive_2020.2022-Delibera_134.2020.pdf	Accessed 31/03/25
2022	Gender-binary distribution of the employees	Gender Equality Plan 2022-2024 for the Italian National Institute of Oceanography and Applied Geophysics (OGS) https://www.ogs.it/sites/default/files/piano%20di%20uguaglianza%20di%20genere%202022-2024%20%281%29.pdf	Accessed 31/03/25

Years	Type	Source	Notes
2024	Gender-binary distribution of professors in Italian Earth Sciences Departments	CINECA website https://cercauniversita.cineca.it/php5/docenti/cerca.php	Accessed 13/01/2025
2020-2022	Gender-binary distribution of italian geologists	Italian National Institute of Statistics (ISTAT) website https://api.inapp.org/professioni/istat.php?codice=2.1.1.6.1&P3=2	Accessed 31/03/25
		Geological Survey of Italy	
1975-2024	Gender-binary distribution of the technical staff	Pichezzi et al., 2013; original data	Figure 3, column E
2020-2023	Gender-binary distribution of people who applied for a job as geologists in public competitions	Original data	Figure 3, column C
2024	Gender-binary distribution of geologists working for the Survey	Original data	Figure 3, column D
2024	Gender distribution at the Geological Survey of Italy	Original data: results of a survey conducted in the summer 2024	The survey, with anonymized responses, represents a first attempt to quantify different phenomena such as the participation of women in field activities or the gender distribution in paid and domestic (unpaid) work.
2021-2025	List of positive actions adopted at GEO-CAR	Original data	Best practices adopted at the office of the Geological Survey of Italy responsible for structural and marine geology, geological field survey and cartography (GEO-CAR).
		Female students in Nursing and Midwifery Sciences	
2018-2023	Gender-binary distribution of students graduated in Nursing and Midwifery Sciences	ALMALAUREA website https://www2.almalaurea.it/cgi-asp/classi/Scheda.aspx?codiceAggr=11106&tipoCorso=LS&lang=it and https://www2.almalaurea.it/cgi-asp/classi/Scheda.aspx?codiceAggr=10043&tipoCorso=L&lang=it	Accessed 04/04/2025

Table 1. *Data and the related sources.*

"gender" and relative categories have been clarified (European Commission, 2020b). When, in a gender statistic, only two categories are considered, it is unfeasible to discriminate whether they effectively represent all genders distribution or if the classification has been inferred to be binary and genders have been assumed from the female and male names counted in a list. In order to stress out the difference between data collected using a "gender-binary" method and data collected with a "gender-open" method we chose to use different colours and labels in graphs and texts: data from previous studies which lack non-binary genders will be reported and discussed in red and grey colours, and labelled with the terms "gender-binary distribution", "female" and "male" (although it might not reflect reality, see also 4.1 Invisibility: the other genders data gap); data including non-binary and other genders, like the survey presented in this study, will be shown in yellow and green colours, labelled with the terms "gender distribution", "women", "men", and, when possible, "other genders".

3. Results

3.1. European Geological Survey organizations

Limited data, not country-disaggregated, are currently available for gender-binary distribution at the Geological Survey Organizations members of EuroGeoSurveys (EGS), an organization coordinating and supporting the European national Geological Surveys. The percentage of female staff in permanent scientific positions shows no significant variation or trend in the years 2017-2022, ranging from a minimum of 38.6% in 2019 to a maximum of 40.9% in 2017 (Figure 1; EGS, 2019; 2021; 2023a; 2023b). A slightly lower value is calculated from data published by Pichezzi et al. (2013) for the year 2010: in a smaller statistical sample of 12 Surveys out of 33, the female technical staff hired at the European Geological Surveys resulted in 37.2%.
It is worth noting that, in 2022, "the category "Other gender" appears (…) for the first time" in a EGS report (EGS, 2023b). That year, the total number of EGS members' staff was 57.39% males, 42.59% females, and 0.02% other genders.
Gender-binary distribution in leadership positions records some changes in the last years (Figure 2): while the composition of technical staff has remained relatively stable, the percentages of female Directors of the Surveys (EGS, 2024a) and project chairs (EGS, 2024b) have increased significantly since 2020.

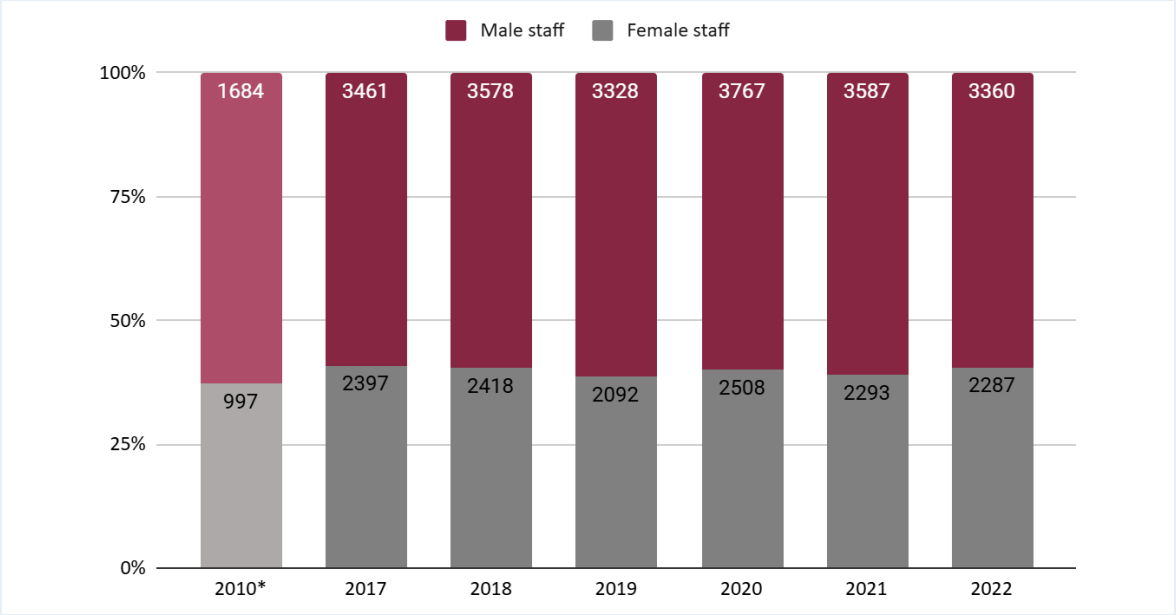

Figure 1. *Aggregated data showing a gender-binary percentage distribution of the scientific/technical permanent staff at the national geological surveys members of EGS (EuroGeoSurveys). Absolute numbers are labelled in columns. *Data for the year 2010 are from Pichezzi et al. (2013) and are shown in a different colour because they refer to 12 out of 33 Country members of EGS in 2010.*

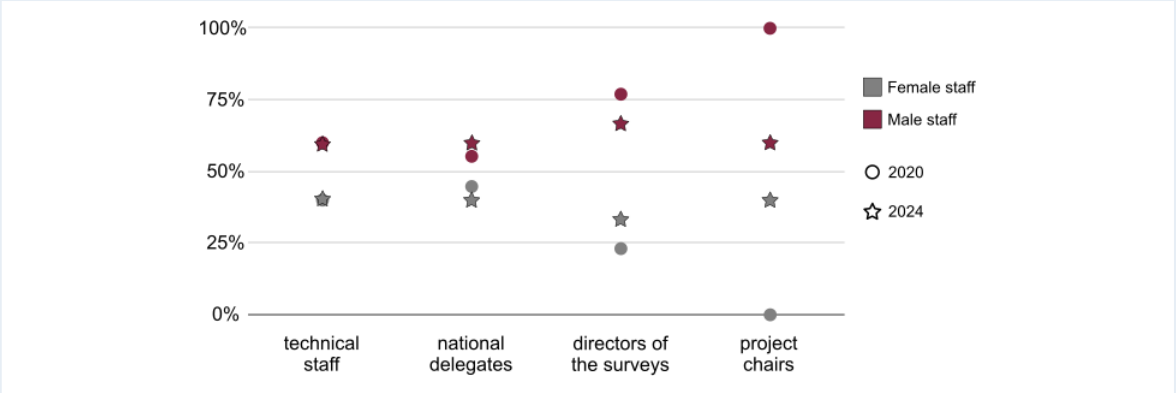

Figure 2. *Distribution of roles at EGS. Stars show the most recent percentages available for each category of female (grey) and male (red) employees: 2022 for "EGS technical staff", 2024 for other categories. Points show the same percentages for the year 2020.*

3.2. Female geologists in Italy

A summary of the data regarding gender-binary distribution of geologists in Italy is presented in Figure 3. Although the data do not cover all areas of work or study in which geologists operate, they provide a useful starting point for quantifying the female presence in the field of geology for the period 2018-2024. The figure includes five categories: students, applicants for technical/research positions, technical/research staff, professors, and professionals.

According to AlmaLaurea (2025a, 2025b), gender binary distribution of graduated students in Geological Sciences between 2018 and 2023 shows that female

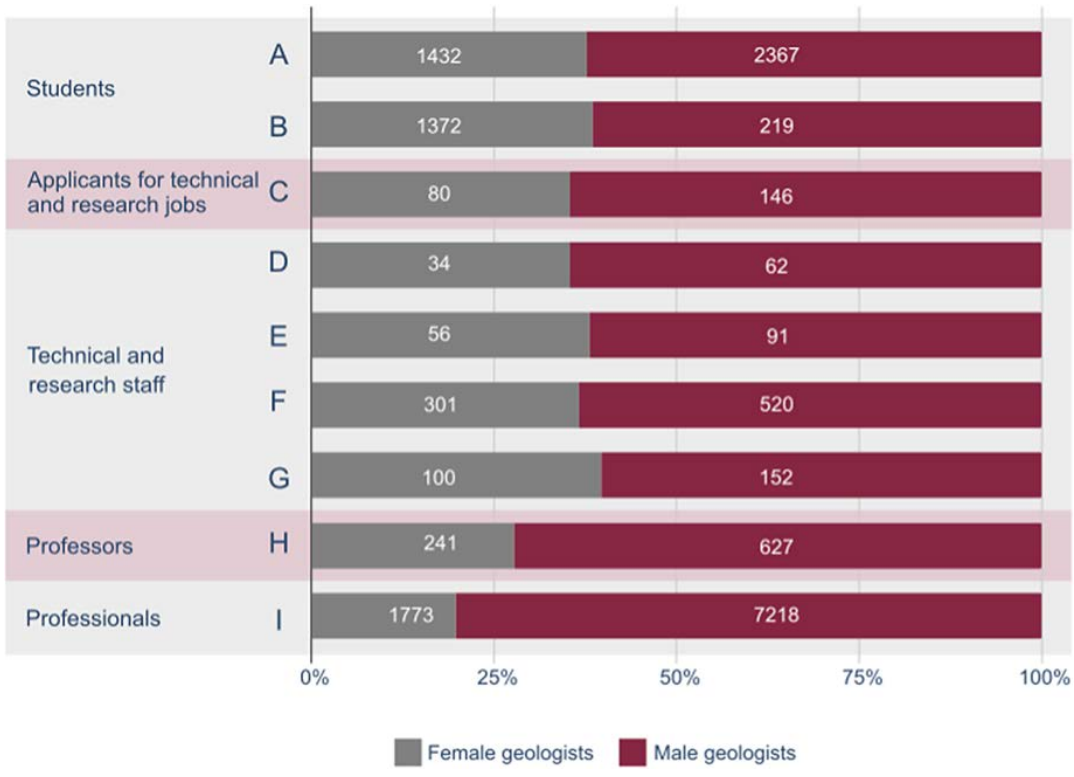

Figure 3. *Absolute numbers and percentages of male (red) and female (grey) geologists in different Italian contexts. A) 2018-2023. BSc (Bachelor of Sciences) Graduated Students; B) 2018-2023. MSc (Masters of Sciences) Graduated Students; C) 2024. GEO-CAR Geologists – Candidates; D) 2024. Geologists at GEO; E) 2024. Research or Technical roles at GEO Department; F) 2019. Research or Technical role at INGV; G) 2021. Research Compartment at OGS; H) 2024. MUR – Professors in Earth Sciences; I) 2018-2020. Professionals (data from ISTAT).*

graduates represented 37.7% of bachelor's and 38.5% of master's. In the same period, the percentage of female applicants for geologist positions (mainly field geologists and biostratigraphers) at GEO-CAR was, overall, 35.4%. The same percentage (35.4%) also represents the female staff with a specific geological background working in 2024 as geologists at the Department for the Geological Survey of Italy (GEO), whereas female staff with a scientific background hired at GEO in research or technical roles accounted for 38.1%. These values are comparable to those recorded in other institutions. For example, the percentage of female staff hired in research or technical positions at the Italian Institute of Geophysics and Volcanology is 36.7% (CUG-INGV, 2020), while in the research compartment at the Italian Institute of Oceanography and Experimental Geophysics is 39.7% (OGS, 2022). Significantly lower percentages are observed among female senior academics and professionals. Full or associate female professors in the Earth Sciences departments of Italian universities represent only 27.8% (MUR, 2024, following Agnini et al., 2020) and just 19.7% are the female professional geologists in Italy (ISTAT, 2022).

3.3. The Department for the Geological Survey of Italy

3.3.1. History and state of the art

In summer 2024, the Department of Geological Survey of Italy (GEO) employed 158 people. Of these, 82% were part of the technical staff (i.e., researchers, technologists, technicians); 12% were administrative staff, and 10% held managerial positions.
Pichezzi et al. (2013) published a study presenting gender-binary distribution among the technical staff (i.e., geologists, engineers, cartographers, lab-technicians, etc.) hired at GEO from 1975 to 2010. Here, we present an updated version of that dataset, extending it with data from the last fourteen years (Figure 4). Figure 4 also shows national-level data on the percentage of female staff employed in any position between 1975 and 2024 (ISTAT 1959-2015; ISTAT 2004-2024). Although the two datasets refer to different categories, the comparison provides a preliminary assessment of potential horizontal segregation: values above the national average suggest an underrepresentation of male staff, whereas values below it indicate an underrepresentation of female staff. Between 1975 and 2001, GEO's female technical staff increased significantly, reaching 44.4% in 2001, less than six percentage points below gender-binary parity and more than five percentage points above the national average for that year (38.8%, calculated from ISTAT data). A drop in female representation in the technical staff followed after 2001 (Pichezzi et al., 2013), likely coinciding with a major structural change in the GEO, which was incorporated

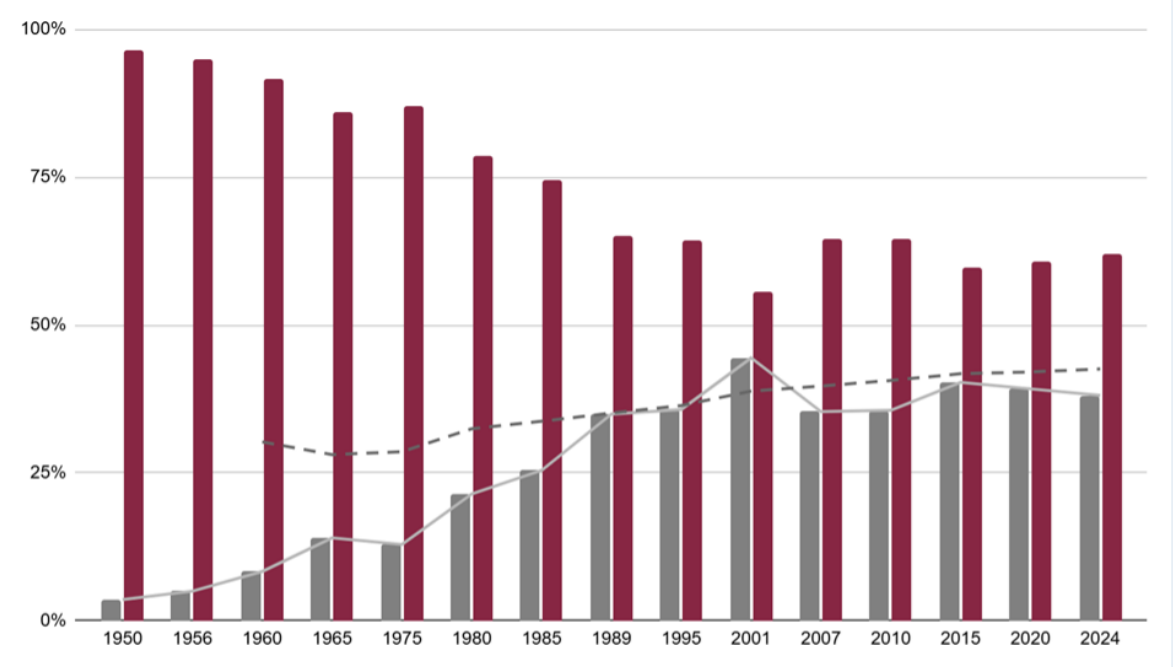

Figure 4. *Percentages of male (red columns) and female (grey columns) employees hired in research or technical positions at the Department for the Geological Survey of Italy (GEO) from 1950 to 2024. The light grey solid line remarks the percentage of female staff at GEO for comparison with the percentage of female staff (15-74 years old) employed in Italy in the same years (dotted, dark grey line; percentages of female employment in Italy is calculated from data available on the website of the Italian Statistics Institute, ISTAT 1959-2015; ISTAT 2004-2024).*

into a larger public institution in 2002. The proportion rose significantly between 2010 and 2015 but has been gradually declining since then.
At the end of 2024, female people made up 38.1% of the technical staff at GEO, over four percentage points lower than the corresponding national average of 42.6% (calculated from ISTAT data).
In 2024, gender-binary distribution in leadership roles showed a notable change compared to 2020: the proportion of female leaders rose from 38% to 43%.

3.3.2. The results of our recent survey

In summer 2024, an anonymized questionnaire was distributed to the 158 GEO employees. The questionnaire focused on both professional and personal/domestic

workloads (i.e., the paid workload performed as a GEO employee and the unpaid workload in private life). The main aims were to: i) quantify who is involved in fieldwork activities, ii) assess the time spent on those activities, iii) understand how unpaid personal/domestic workload is distributed across genders. Fifty percent of the staff (i.e., managers, technical and administrative employees) responded to the survey with 79 out of the 158 employees participating. A complete list of the questions asked, and a selection of the results can be found in the supplementary materials Appendix 1 and Appendix 2.

The age distribution of respondents is relatively homogenous: 17.7% are 30-40 years old; 29.1% are 40-50 years old; 29.1% are 50-60 years old; 24.1% are over 60 years old. With respect to job positions, 87.3% of respondents work in research or technical roles, 11.4% work in administrative positions, and 1.3% are managers. A total of 92.4% benefit from agile work.

Gender distribution among respondents shows that 51.9% are women, 46.8% are men, and 1.3% are non-binary or other genders.

Among women at GEO, 66.1% participated in the survey compared to 38.5% of men. Additionally, 82.9% of women respondents and 67.6% of men respondents reported having caregiving responsibilities (Figure 5). In the following paragraphs and figures,

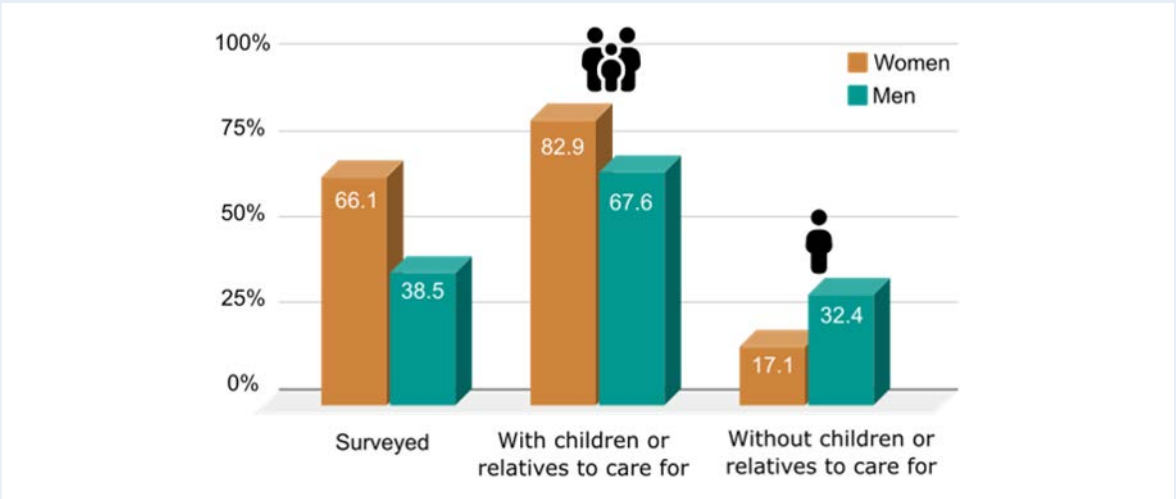

Figure 5. *Results of the questionnaire administered to the GEO staff in summer 2024. Columns on the left show the share of women (yellow) and men (green) surveyed, relative to the total female and male GEO staff, respectively. Columns in the center show the shares of surveyed women and men having caregiving responsibilities. On the right, shares of care-free women and men.*

selected results are presented. All percentages are gender-disaggregated – i.e., they refer to the share of women or men reporting a certain condition or activity relative to the total number of female or male employees of GEO. Due to the very limited number of non-binary respondents, those data are not included in the gender-specific analysis as they are deemed not statistically representative.
According to the survey results, field activities constitute part of the workload for the majority of employees. Figure 6 shows the number of respondents who reported spending part of their working time in the field, disaggregated by women and men and by the proportion of working time spent outside the office.

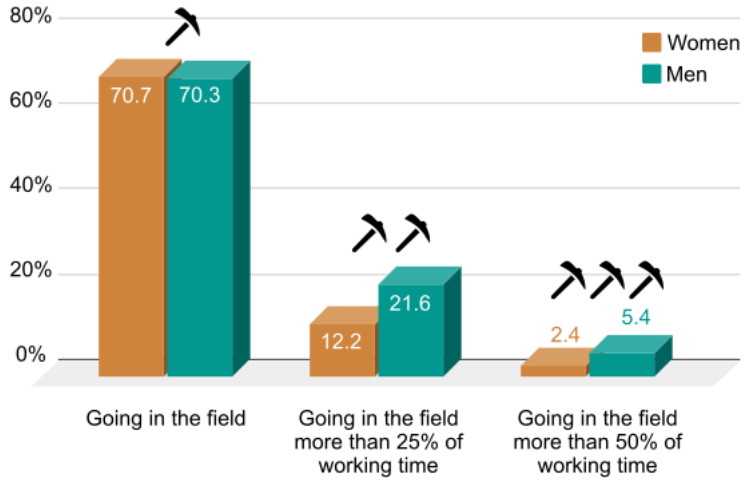

Figure 6. *Field activities at GEO, results of the questionnaire. Time and gender disaggregated percentages of employees doing field activities.*

Overall, 70.5% of the respondents reported participating in some kind of fieldwork: gender- disaggregated percentages indicate that 70.7% of women and 70.3% of men are engaged in field activities as part of their duties. However, differences emerge when considering the time spent in the field: 12.2% of women and 21.6% of men reported spending more than 25% of their working time on field activities; 2.4% of women and 5.4% of men reported spending more than 50% of their working time on fieldwork.
Figure 7 shows the proportion of surveyed employees who have benefited from parental leave or from Law 104, an Italian law establishing special leaves for employees with

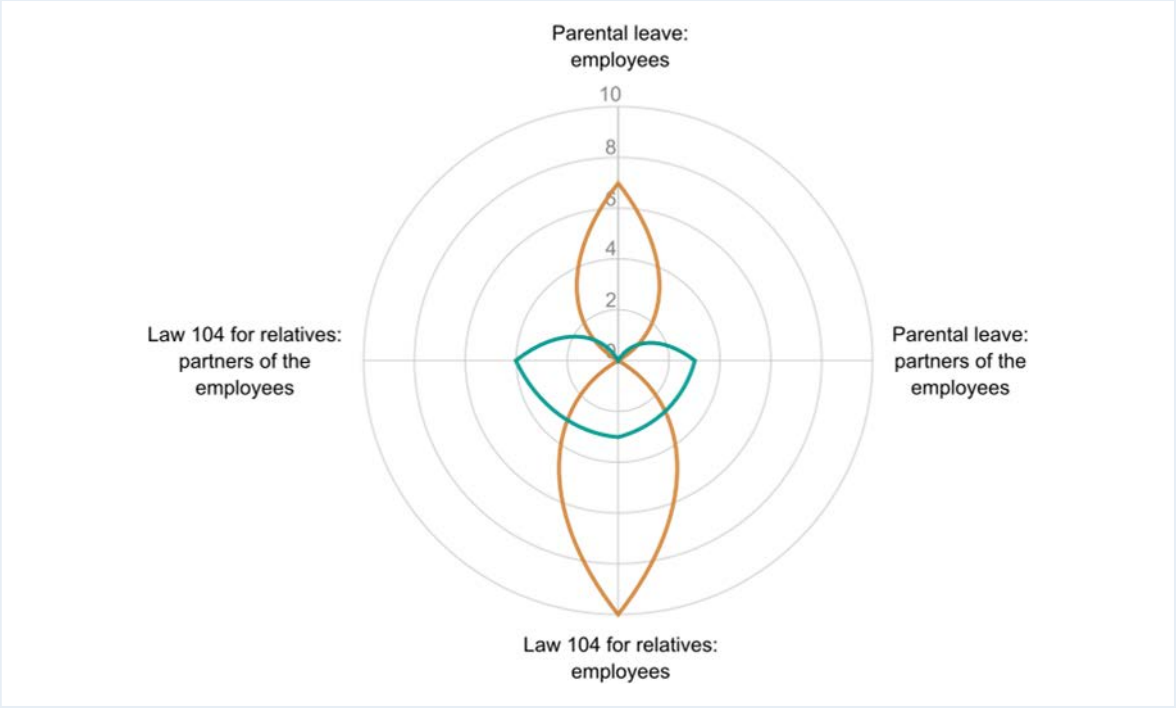

Figure 7. *Spider diagram showing the distribution, between surveyed women (yellow line) and men (green line), and their partners, in the use of law facilities (parental leave and law 104) in life-work balance.*

a disability or those caring for a disabled relative (Gazzetta Ufficiale, 1992; L.104/92). None of the men (0%) declared to have ever taken parental leave, whereas 8.1% indicated that their partners had. Additionally, 10.8% of men currently benefit from Law 104 for a relative, as do an equal percentage (10.8%) of their partners. A higher proportion of women reported either having used parental leave (17.1%) or currently benefit from Law 104 for a relative (24.4%). Notably, none of their partners (0%) were reported to have used neither of these provisions.

The questionnaire listed the most common motivations for choosing the option to work from home or remotely, and asked respondents to assign a level of importance ("not at all important", "important enough" or "very important") to each of them. Figure 8 shows the reasons most frequently rated as "very important", disaggregated by women and men. The percentages are relatively similar when considering time-saving (for personal use or for housework). Slight differences emerged in the percentages regarding cost savings. A more pronounced gap was observed

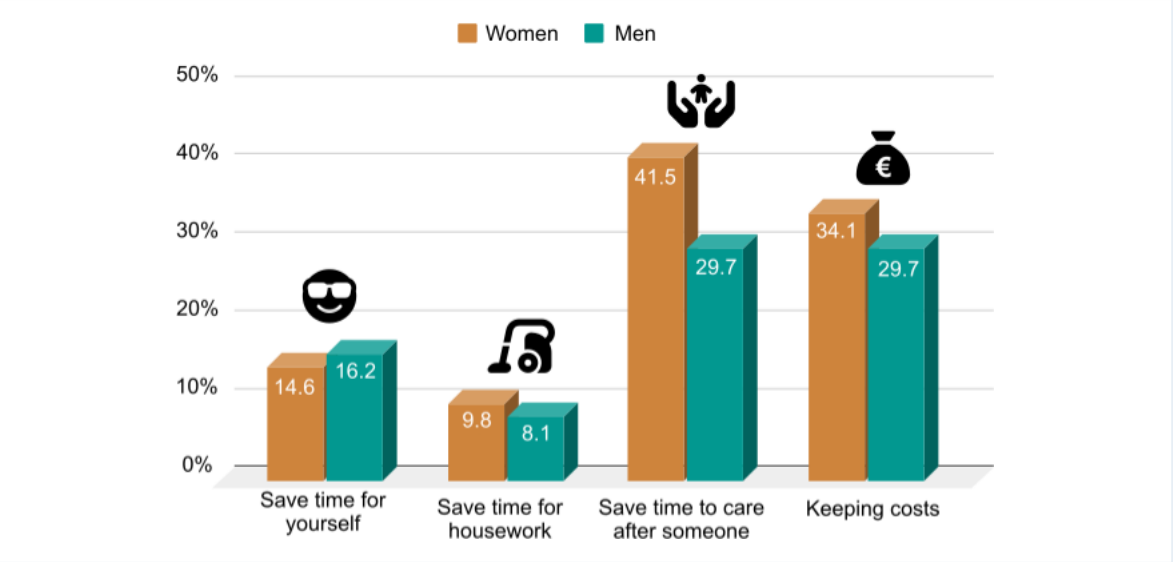

Figure 8. *Result of the survey: reasons for choosing agile work perceived as "very important" by women (yellow) and men (green).*

in caregiving responsibilities: 41.5% of women reported choosing working from home (hereafter defined as "agile work") to care for someone, compared to 29.7% of men. A significant difference between women and men also appears in the time spent on unpaid caregiving activities. More than half of the women respondents (53.7%) reported spending over 50% of their free time on caregiving, compared to 29.7% of the surveyed men.

3.3.3. Best practices at GEO-CAR

GEO-CAR, the office within GEO where the authors work, is primarily responsible for geological field surveying and mapping. It is a noteworthy case, as the office is led by a woman, and three out of four operating units' managers are also women. The current technical staff consists of 46.3% female components and 53.7% male components. Between 2021 and 2024, GEO-CAR expanded its staff by hiring 18 new employees, including 6 women. Several of the newly hired staff members had caregiving responsibilities, prompting adjustments in the working practices

to accommodate those needs. For example, children have been welcomed during informal video meetings and even during meals on field campaigns. The office manager allowed employees to choose agile work without a fixed schedule. Return from maternity leave has been agreed with the managers on a case-by-case basis, and hybrid solutions – such as alternating agile work and parental leave – have been implemented and tested.

4. Discussion

The results presented in this study are based on data collected with the objective of quantifying the presence and the situation of women working at the Department for Geological Survey of Italy (GEO). The aims were twofold: i) to trace the evolution of female staff at GEO, and ii) to compare this representation with that observed in other Italian and European institutions and contexts. A specific focus was placed on identifying different forms of segregation affecting GEO. These include: i) horizontal segregation, evident in Earth Sciences across academic and professional sectors, ii) segregation in fieldwork activities, often influenced by implicit gender norms, iii) "reverse" horizontal segregation, related to the unequal distribution of unpaid domestic and care workload, iv) vertical segregation, referring to underrepresentation in leadership positions. During the research, another form of segregation emerged – perhaps better described as invisibility – concerning the absence of other genders in most public data.

4.1. Invisibility: the other gender data gap

In almost all the websites and official documents cited or consulted for this study, gender statistics account exclusively for two genders: women and men. An additional category of "other" gender appears for the first time only in 2022 in the reports of EGS (Figure 9a. EGS, 2023a, 2023b). Invisibility is a form of segregation because it doesn't allow any assessment of possible intersectional discrimination towards the not-represented categories (Criado-Perez, 2019).
Neglection of gender variability in official documents is common and appears to be strictly linked to the conflation and misunderstanding in the concepts of sex and gender when compiling quantitative gender data and statistics (see also "2. Data, data issues and lexical notes"). To address this issue, it is essential that statistical surveys explicitly state how the data were collected, clarifying to the users whether the information reflects a "gender-binary" dataset or a "gender-open" dataset and

if the collection of data is based (or not) on self-identification. The "gender binary" method, beyond being formally incorrect, could make gross mistakes by ignoring transexual people (people might have a female name being a male and vice-versa) and could be unenforceable in many cases (for example with foreign names, which might not be sex-related).
Due to these multiple issues, "gender-binary" based statistics might be of little significance and should be necessarily complemented, if not replaced, by "gender-open" based data, accounting for the existence of non-binary and other gender identities. This can be achieved, for example, through anonymous questionnaires that allow respondents to choose from a wider range of gender identities or to define their own: the questionnaire proposed to GEO employees in summer 2024 is an attempt to obtain consistent data on gender variability in a public institution. Importantly, data collection must be conducted with the active engagement of the people identified as the target, to ensure both accuracy and respect. Engagement itself can serve as an indicator of awareness within targeted people. A revealing example emerged from our internal survey: one participant, when asked to indicate its gender (choosing from: i) woman, ii) man, iii) non-binary, iv) none of the above), selected option iv and commented "I am a cat, or maybe an alien. Please behave…". This response, though likely meant sarcastic, might underscore a lack of awareness, a discomfort with gender diversity, and/or the fear of discrimination in the workplace on the basis of sexual orientation and gender identity.

4.2. Horizontal segregation

European data on gender-binary distribution within National Geological Survey Organizations reveal limited changes in the last years (Figure 1): the proportion of female technical staff remains relatively stable around 40%, consistently falling short of equal representation with the male counterpart.
Italy follows a similar trend: the percentage of female technical staff at various research institutions is slightly lower than the European average yet remains broadly comparable (Figure 3).
Horizontal segregation of female geologists is also evident in universities. Among geology graduates, the female component is 37.7% for BSc's degrees and 38.5% for MSc's degrees. For comparison, in Nursery and Midwifery Sciences, a faculty typically considered as "feminine", the female component represents 79.2% and 71.9% (BSc and MSc graduates, respectively. Figure 9b. AlmaLaurea, 2025a, 2025b).
At GEO, the share of female applicants and hires is 35.4%, slightly lower than the percentage of female graduates in geology. This representation declines more sharply

at higher levels of the academic and professional hierarchy. Female components account for only 27.8% of Earth Sciences professors and 19.7% of geologists in Italy. These data allow for some considerations:

1. The disparity between the percentage of female graduates and the overall number of geologists in Italy may reflect a generational change – i.e., a positive process of reduction of segregation within this professional field, considering that many current geologists graduated when the female component in geology was significantly lower.
2. The fact that female applicants for GEO-CAR positions represent a slightly lower percentage than their presence among graduates is notable, especially given the high employment rate for female geology graduates in Italy (over 88%, AlmaLaurea, 2024). This may suggest that female geology graduates often find employment, but not necessarily as geologists. It would be valuable to investigate how many pursue alternative careers, such as teaching in middle or high school.
3. The percentage of female technical staff at GEO and in different Italian research institutes is considerably higher than the percentage of female professors in Earth Sciences. Even more striking is the difference with female geologists working as professionals. The scarce number of female geologists working as professionals might in part be explained by the fact that Italian female workers prefer more stable positions in public institutions, which also offers stronger employment protections: in 2024, the female component accounted for 58.9% of all employees hired in public services (ISTAT, 2024). The gap between research institutes and academia, though, needs different explanations. Different recruitment and career standards may disproportionately disadvantage women in academic careers (Minello, 2022; Alfano et al., 2025), while structural biases may inhibit female progression (Agnini et al., 2020).

Within this broader context, historical data indicate a steady increase of female technical staff at GEO since the 1950s. Notably, despite the general underrepresentation of the female component in technical positions, there have been specific years, such as 2001, when the proportion of female technical staff at GEO slightly exceeded the national average of female employees across all sectors. In contrast, decreases in female representation at GEO were observed in 1989, 1995, and 2015 (Figure 4). Two notable declines in the otherwise positive trend at GEO deserve attention: i) after 2001, coinciding with a major structural change in the institution, when the GEO was "transferred to the newly established Agency for Environmental Protection and Technical Services (APAT)" (Pichezzi et al., 2013); ii) after 2015, when a slight but persistent downward trend emerged – one that diverges from the continuing increase

in the national employment rate for occupied women in the Country (Figure 4). This trend warrants monitoring.
Horizontal segregation also appears to influence more specific aspects of professional activity, such as the amount of time spent in the field (Figure 6). Particularly, in this context is an anonymous comment from a woman responding to the survey about reasons for choosing agile work (working from home): "I benefit from agile work to be more often at home and balance my absences due to fieldwork". This testimony highlights how professional duties with a high logistical burden, like fieldwork, may still carry unequal consequences in private life, often leading women to seek adaptive strategies such as agile work.

4.3. Vertical segregation

Some encouraging progress has been observed in equalizing the concentration of women and men in different grades, levels of responsibility or positions (i.e., "vertical segregation", EIGE, 2025) and in breaking the "glass ceiling" (i.e., "removing all those artificial impediments and invisible barriers that militate against women's access to top decision-making and managerial positions in an organisation", EIGE, 2025): the representation of female components in leadership positions within EuroGeoSurveys (EGS), in its national Geological Survey members, and at GEO has raised in the last years. Data from EGS show a steady increase in the female percentage serving as directors of national Geological Surveys and as project leaders within EuroGeoSurveys between 2020 and 2024 (Figure 2). A similar positive trend is evident also at GEO, where the gender gap in leadership positions has decreased over the same period (Figure 9d). It is noteworthy that many official reports on gender statistics analyze data on career progress and/or leadership roles, thus providing data on vertical segregation (e.g., CUG-INGV, 2020; OGS, 2022; ISPRA, 2023).

4.4. Reverse segregation

An opposite form of segregation emerges from data concerning the distribution of unpaid, domestic, and caregiving workload at GEO. The unequal burden of private responsibilities, disproportionately carried by women, is well known: its rebalancing is listed amongst the targets of the United Nations Fifth Sustainable Development Goal (United Nations, 2025) and specific indicators are used by EIGE to quantify it (EIGE, 2024). In official reports, data concerning this specific aspect of gender

gap are usually indirectly obtained from gendered disaggregated data concerning the use of permits, parental leave or the number of days employees work from home (e.g., ISPRA, 2025). The survey proposed to GEO employees in summer 2024 attempts to quantify the amount of private workload by asking targeted questions: even though self-administered surveys have limitations (Chan, 2009), we argue that these types of surveys might be a valid help to obtain detailed data on distribution of caring responsibilities.

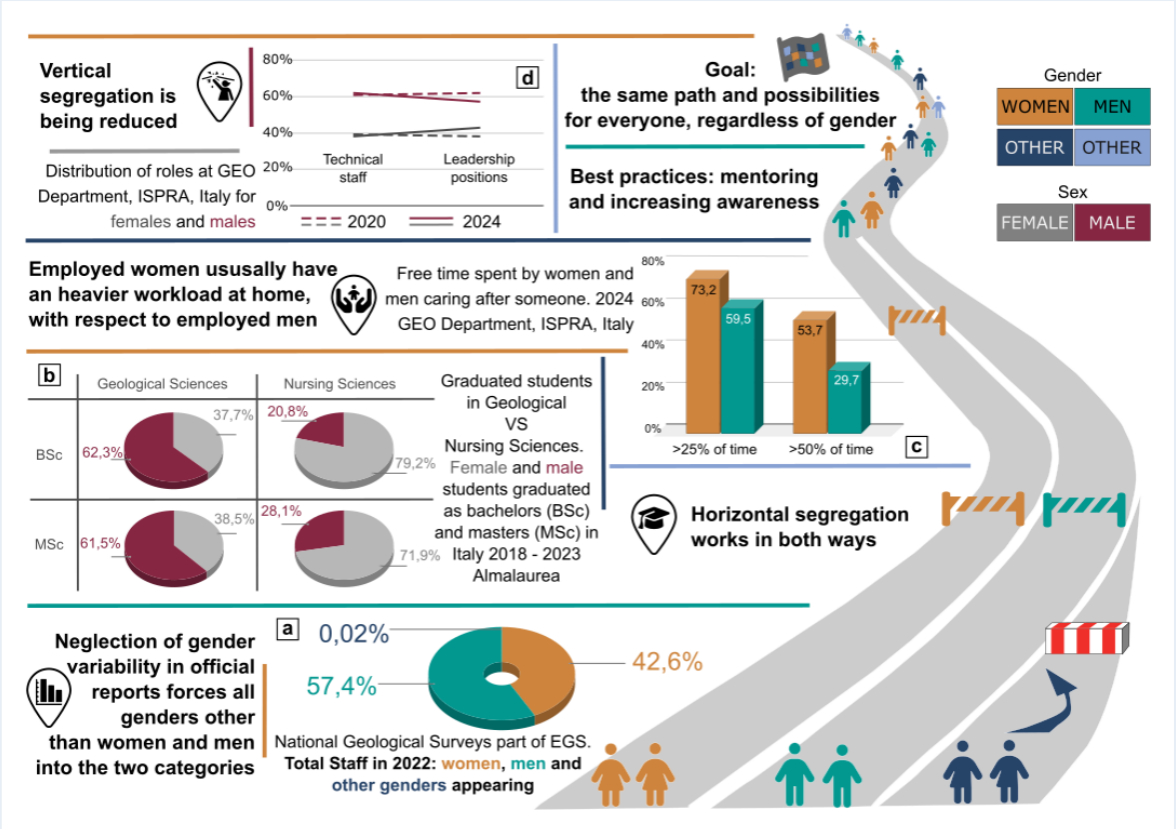

Figure 9. *Infographic on different types of segregations encountered when undertaking a career in Earth Sciences. Following the road, from bottom to top: a) In most official National and European documents only women and men are listed. No other genders are considered (data in the graph are from EuroGeoSurveys, EGS, 2023a; 2023b). b) Horizontal segregation disadvantages female high school graduates in undertaking Earth Sciences' studies (data in the graph are from AlmaLaurea 2025a; 2025b; 2025c; 2025d). c) Even with a job, women are still bearing most of the private, unpaid, care work (data in the graph are the results of a survey administered at GEO in summer 2024). d) Good results are recorded in the process of breaking the glass ceiling in many European Geological Surveys (see also 4.2 "Vertical segregation"), including in the Department for the Geological Survey of Italy (data in the graph are from ISPRA internal statistics).*

A clear disparity is reflected in the survey responses: for example, a lower proportion of men completed the survey, which may indicate a reduced sensitivity to the topic. None of the men respondents reported having ever taken parental leave, despite it being a right guaranteed by law. Furthermore, men are also underrepresented among those who benefit from Law 104, to care for their relatives (Figure 7). Respondent men reported dedicating significantly less of their "free" time – that is, time outside paid employment – to caregiving someone (Figure 9c). In examining the reasons considered "very important" for choosing agile work (Figure 8), it is noteworthy that the only reason considered important for a higher percentage of men was "save time for yourself".

Despite these imbalances, the data also reveal some positive signals. While both public (paid) and private (unpaid) workloads remain strongly gendered, a substantial percentage of the respondent men indicated a degree of active involvement in the private workload.

Local initiatives implemented at GEO-CAR (e.g., welcoming children to participate in informal video-calls or to join meals during field campaigns; agile work without fixed days, etc.), initially designed to support mothers of very young children, contributed to an overall improvement in the workplace environment, indirectly encouraging fathers to also engage more actively in family care responsibilities. On the downside, certain measures, although well-intentioned, can prove difficult to manage in practice. For example, bringing a small child on a field trip necessitates additional care arrangements – someone to care for the child – potentially increasing the burden on the family.

Similarly, extensive use of agile work by women can also inadvertently lead to an increase of their unpaid domestic workload. This dynamic mirrors trends observed during the COVID-19 pandemic, where remote work intensified women's care responsibilities within the household (Power, 2020).

4.5. Diversifying paths

The divergence in gendered paths begins at a very early stage, even in preschool settings (Martin, 1998) and continues through higher education choices (Figure 9b). Both female and male high school graduates exhibit strong gender biases in their educational trajectories: the former tend to choose disciplines often oriented on care work, whereas the latter tend to avoid fields perceived as "feminine" due to fear of social stigma. Earth Sciences are still considered a male-dominated domain, and men continue to be favoured in some professional pathways. Within the context, GEO – similarly to other institutions such as INGV and OGS – represents a positive

exception. Although full gender parity has yet to be achieved, the high number of female employees in technical positions, alongside a recent reduction in the gender gap in leadership roles, suggests a movement in the right direction. A further positive sign is the attention paid by the GEO-CAR to women undergoing vulnerable phases of their personal lives. The recognition of specific needs, and the tailored strategies implemented to meet them, constitutes concrete steps toward enabling continued participation in the workforce. This approach – rooted in attentiveness and responsiveness to individual needs – can itself act as a tool to counteract gender stereotypes.

Applied more broadly, such practices may also benefit men and individuals of other genders, fostering a less exclusive and more supportive work environment overall. The significant presence of women in leadership roles at GEO-CAR contributes to mentorship opportunities for younger women interested in pursuing similar careers. A positive action that could further support gender equality would be the systematic collection of data at GEO to quantify gender distribution of both private and public workloads. Engaging employees in such efforts would help raise awareness while also making both gender diversity and the burden of private workload – still largely borne by women – more visible. Quantifying the extent and distribution of unpaid care work is a necessary precondition for recognizing its value. Its current lack of visibility contributes to its devaluation and reinforces its role in gender segregation. At the same time, initiatives such as those piloted at GEO-CAR, aimed to support employees in balancing private and professional workload, should be encouraged, tested, and critically evaluated. Understanding their benefits and limitations could provide a solid foundation for a broader reassessment of the structural causes of imbalance and stimulate further discussion around effectiveness and equitable workplace policies.

5. Conclusions

A substantial body of data highlights the persistence of both horizontal and vertical segregation of women within European Geological Survey organizations and at the Department for the Geological Survey of Italy (GEO). The female percentage of employees working in technical positions appears to have plateaued, likely reflecting the enduring influence of culturally gendered choices in educational and career pathways. While vertical segregation has diminished in recent years, evidenced by an increasing number of female leaders in many EGS projects, European Geological Survey Organizations and offices within GEO, significant disparities persist. One noteworthy approach has been adopted by the GEO-CAR

office, which deals intensively with geological surveying and mapping at GEO, focusing on the identification and satisfaction of employees' needs. This strategy has aimed to facilitate the participation of women in both office-based and field-based work, including during vulnerable phases of their lives, such as motherhood. Although this supportive environment has generally contributed to improved workplace wellbeing, the long-term effectiveness of some best practices remains to be fully evaluated. The limited visibility of men's roles in private care work has important implications for women's career choices, and addressing this imbalance is crucial for promoting broader gender equality. Finally, the lack of representation of genders other than women and men in official statistics prevents the recognition and thus the redress of potential inequalities faced by these people: fostering welcoming environments requires both structural changes in data collection and cultural shifts in understanding gender. There is an urgent need for a systematic and actively participated data collection on both gender multiplicity and distribution of private (unpaid) workloads: the questionnaire proposed in this work is a replicable attempt to quantify and address these issues. The correct assessment of gender variability and gender inequalities are fundamental steps towards a truly equitable and supportive working environment, also across the geological sciences.

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Notes. This work is eminently practical in nature and is based on the experience of ISPRA geologists, who engage directly with the topics discussed. For this reason, some words, expressions or concepts mentioned in the text might be improved. Please, send any comments or suggestions to the corresponding author.

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https://eurogeosurveys.org/research/our-experts/marine-geology/
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Appendix 1. Questions asked in the "ISPRA-GEO" Survey

★ Gender
- ○ Woman
- ○ Man
- ○ Non-binary
- ○ None of the above (please, write how you'd like to define yourself in the space below).

★ If you select "None of the above" in the section above, please specify how you like to be defined.

.....

★ Age (yr)
- ○ 18-20
- ○ 20-30
- ○ 30-40
- ○ 40-50
- ○ 50-60
- ○ >60

★ Do you have a partner?
- ○ YES
- ○ NO

★ Do you have children?
- ○ YES
- ○ NO

★ If you answered "YES" to the previous question, please complete the following grid:

	1 child	2 children	3 children	>3 children
Younger than 3 years old				
3-6 years old				
6-12 years old				
12-18 years old				
Older than 18 years old				

★ Do you have parents to care for?
- ○ YES
- ○ NO

★ Job position
- ○ Administrative
- ○ Technologist
- ○ Researcher
- ○ Manager

★ Work activities. Please indicate here the percentage of time spent on the activities listed below.

	<10% of time	10-25% of time	25-50% of time	50-75% of time	>75% of time
Office work					
Field activities					
Lab activities					
Representation activities					
Meetings (in person or online)					

★ Do you do flexible working?
- ○ YES
- ○ NO

★ How many days per month do you generally do home-working?

.....

★ Some of the most common reasons for choosing to work from home are listed below. Please indicate how much each of them influenced your decision to work from home.

	Not at all important	Important enough	Very important
Save time for myself			
Save time to do housework			
Save time to care for your partner/children/parents/ someone else			
Reduce the cost of commuting			

★ Please indicate here if there are other reasons why you choose to do home-working.

.....

★ During the last year have you done any of the following activities, for someone else, for free?

	Help with housework	Preparing meals	Bureaucracy or commissions	Accompanying/ transport
Parents/In-Laws				
Children / sons or daughters-in-law				
Sieblings/Sieblings-in-law				
Other relatives				
Friends				
Neighbors				
Other people				

★ For each category indicated in the previous section, what percentage of your free time is spent doing unpaid activities?

	<10% of free time	10-25% of free time	25-50% of free time	50-75% of free time	>75% of free time
Parents/In-Laws					
Children/sons or daughters-in-law					
Sieblings/Sieblings-in-law					
Other relatives					
Friends					
Neighbors					
Other people					

★ Do you benefit or have benefited from any of the following provisions provided by law?

- ○ Non-compulsory parental leave
- ○ Law 104 (for myself)
- ○ Law 104 (for relative)
- ○ Other (please specify in the next section)

★ Your partner (if you have one) benefit or have benefited from any of the following provisions provided by law?
- ○ Non-compulsory parental leave
- ○ Law 104 (for myself)
- ○ Law 104 (for relative)
- ○ Other (please specify in the next section)

★ If you have selected “other” in the previous section please specify here

.....

Appendix 2. Results from a questionnaire at GEO. N/O: Non-binary or Other genders

Gender	W	M	N/O
	41	37	1

Age (yr)	W	M	N/O
30-40 yr	5	9	1
40-50 yr	13	9	
50-60 yr	12	11	
>60 yr	11	8	

Job position	W	M	N/O
Research or technical staff	38	30	1
Administrative staff	3	6	
Managers	0	1	

Benefit from agile work	W	M	N/O
YES	38	34	1
NO	3	3	0

PERSONAL QUESTIONS

Partner	W	M	N/O
YES	32	31	1
NO	8	6	0
NO ANSWER	1	0	0

Children	W	M	N/O
YES	25	22	1
NO	16	15	0

Other relatives to care for	W	M	N/O
YES	24	15	0
NO	17	22	1