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Women in Mexican paleontology: a pioneer's legacy

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Abstract

This work presents a gender perspective on the role of women in the development of Mexican Paleontology, in historical times, when this research area was barely considered as a scientific discipline on its own. The pioneering work of explorers and naturalists, especially A. von Humboldt, resulted in a favorable context for the incorporation of geosciences and the eventual development of paleontology as an official science. Nonetheless, the emergence of Paleontology as a new science in Mexico was preceded by a series of changes in the economy and in the sociopolitical aspects of the Mexican society. The creation of multiple scientific societies during the last decades of the 19th century, allowed a gradual change in the scientific paradigm when the new century arrived, but not large enough to encompass the participation of women in science. The professional collaboration in interdisciplinary teams of scientist working toward common goals was key to promote the establishment of Paleontology as an independent and solid research line by itself. Women contributions, generally ignored or overlooked, were fundamental for the evolution of Paleontology. In spite of the regional context in Mexico, the international context was gradually opening its doors for women scientists.

Keywords: Female professional career, Mexico, Paleontologists, Pioneers of Paleontology, Women scientists.

Resumen

Este trabajo presenta un breve análisis con perspectiva de género sobre el papel que las mujeres han desempeñado en la Paleontología de México cuando esta ciencia apenas se estaba conformando como área de especialización independiente. El trabajo pionero de A. von Humboldt generó un contexto muy adecuado para la inserción de las geociencias y eventualmente, para el desarrollo de la paleontología como ciencia oficial. El surgimiento de la Paleontología como una nueva ciencia en nuestro país, fue precedida por una serie de cambios en economía, política y aspectos socioculturales de la sociedad mexicana. La creación de múltiples sociedades científicas durante las últimas décadas del siglo XIX, permitieron un cambio gradual de paradigma científico en los albores del nuevo siglo, pero no lo suficientemente grande como para incluir la participación femenina en la actividad científica. La colaboración profesional entre equipos interdisciplinarios de científicos trabajando para un mismo objetivo, fue clave para impulsar el surgimiento de la Paleontología como una ciencia por sí misma, donde las contribuciones femeninas, generalmente ignoradas, fueron fundamentales para su desarrollo. Pese al contexto regional, a nivel internacional ya se estaba abriendo a la participación de mujeres científicas en este campo.

Palabras clave: *carrera profesional femenina, México, mujeres científicas, paleontólogas, pioneros de la paleontología.*

1. Introduction

Science's history shows that bright women have been almost forgotten in most disciplines such as physics, astronomy, mathematics, chemistry, oceanography and biology. In the history of paleontology, this situation is not different. The prominent work of Mary Anning as discoverer of the first ichthyosaur skeleton (1824), stands out as the most emblematic participation of a woman in a discipline of Earth Sciences. As a daughter of an amateur fossil hunter, she not only collected numerous fossils as a non-certified paleontologist, but also made insightful descriptions on morphology, sedimentology and geology; she was a true geoscientist. Great figures of the golden age of British geology generated their new ideas and models based on her work (Creese and Creese, 1994). Also, Elizabeth Philpot (1780 – 1857), a British fossil collector that met Mary Anning, had a crucial ability for paleontological studies at that time: she could accurately draw the morphology of fossils remains (Kölbl-Ebert, 2012). Other unappreciated name correspons to the marine biologist and paleontologist Mary Morland Buckland (1797 – 1857), and included in this unappreciated female group is the American Annie Montague Alexander (1867 – 1950), who established the Paleontological Museum of the University of California (UCMP), as well as the Museum of Vertebrate Zoology, both from the University of California, at Berkeley. It is with these contributions that the interest and love for fossils from many women and men was born in the world.

In Mexico, the professional incursion of women in paleontology had to wait some decades after the official foundation of different disciplines in Earth Sciences. The curiosity that motivated the geological mapping of the country began with the extraction of minerals and the exploration of primary resources, and consequently, many fossils were discovered. Therefore, it is correct to say that Mexican paleontology was born together with geology and mining, although, at that moment, these disciplines were considered as part of the Natural Sciences.

2. An historical perspective

Since pre-Hispanic times, the indigenous communities of Mexico have exploited the vast richness of non-renewable natural resources found within our territory, like minerals, carbon, petroleum, bitumen and construction materials. Due to the exploration related with such prime resources, many fossils were discovered and even when they were not given any scientific value, some of them were given religious or mythical value (Mayor, 2000, 2005; Lyons, 2009). During the Spanish conquest, a more formal study of fossils received an emerging interest. For several years, Hernán Cortés sent back to Spain some fossils of great size, among other mineralogical wealth. Around 1590, Jesuit priest and naturalist J. de Acosta even questioned the origin of these fossil findings. His observations and works were referenced in the Natural History of the Indies (Gío-Argáez and Rodríguez-Arévalo, 2003).

The study of geology in our country began since the 18th century, when foreign naturalists were attracted by the enormous variety of geological phenomena that the national territory presented. For a long time, men were the only ones focused on data collection, field and cabinet research in all disciplines related to geology, such as paleontology, edaphology, hydrology, and peculiarly mining. In fact, mining was highly valued for the discovery and extraction of minerals that allowed the economic development. Mexico was already a mining country before the conquest (1521) and remained as such until large gold and silver mines were discovered in Oaxaca, Hidalgo, Guanajuato and Zacatecas. During the foundation of the Royal Seminar of Mining in 1792, which later became the National School of Engineers and eventually, part of the Faculty of Engineering of the UNAM, the scientific study of minerals and rocks really began in the 19th century. It can be said that mining studies gave impetus to the development of the Earth Sciences at the beginning of the 20th century; later on, petroleum geology, geology and paleontology made their appearance in a commercial way, as did geophysics, which developed in parallel with petroleum geology (López, 1988).

With the foundation of the School of Engineering within the University, an unusual event occurred in 1910: Miss Dolores Rubio Ávila applied for enrollment in that school and became a metallurgist (Alvarado, 2002). This fact distinguishes her not only as the first woman graduated from the Faculty of Engineering, but also as a brave woman who challenged the social tradition and common belief that women could not exercise a male profession. Years later, another woman repeated the story in the same school: Josefa Cuevas de Sansores, who also was the first woman geologist in Mexico; she won an honorable mention in 1950 too (Sánchez and Tagüeña, 2011). These two women are recognized for having ventured into disciplines in which only men were normally accepted, since historically there have been professions typified as male domains (Suárez, 2017).

3. Women ought to be warriors

Ignacia Rodriguez de Velasco y Osorio Barba (better known as "*la güera Rodriguez*"), a mutual friend of A. von Humboldt and Agustin de Iturbide, was an intelligent and attractive widow that, somehow, had an influence on some of the key actors responsible for the democracy of knowledge at the beginning of the 19th century, but without any further mythical assumptions (Arrom, 2019). Nonetheless, the main virtue of la güera Rodriguez was to be aware of prominent women that alternated with men in power, not from an equality position, but rather as a nice and decorative company. Except for a few cases like this,

the socially accepted roles for women were those if wife or nun; anything else was considered as abnormal; therefore, most women, rich or poor, were confined to domestic chores.

Even today, some women are chosen to play a decorative role even in the Academy; even more, some women choose to play that role, but most women honestly fight to enter their academic careers on a fair basis. Indeed, during the celebration of the First and Second National Instruction Congress of 1889, the general reflection was not "why" but "how much education is convenient for women?" (Morales-Jurado, 2005). In Mexico, the professional incursion of women in paleontology had to wait some decades after the foundation of the different disciplines of Earth Sciences. Sewing, reading, piano lessons and even mathematics were part of a feminine and convenient education for women. Odd enough, writing was never taught as it was considered subversive (Morales-Jurado, 2005).

The widespread idea that women are suited only for domestic assignments was not exclusive of Mexico. In Europe, throughout the nineteenth century, women in science were difficult to find. Universities at that time were exclusively for men; moreover, in many cases, their names and contributions were signed under a man's name (professor, spouse, father, etc.). In fact, there are well-known literary texts written by women during this period of time, hidden under a male outfit, as Georges Sands, just to mention an example (Montero, 2002). Women's participation in science was biased even in England, a country in which 65% of written papers were published by British women (Creese and Creese, 1994). The examination of these historical documents reveals that British women, mostly unofficially, contributed to geological research as associates, field-assistants and secretaries in charge of the technical preparation of paleontological materials, but never represented a real or serious competition for men simply because the system ignored them.

Throughout science history, the filters used to evaluate academic performance are different for men and women: women have to work harder, achieve longer periods of academic success and prepare lots of graduate students in order to be acknowledged. It is not politically correct or welcomed for a woman to be ambitious up to the point of desiring a "man's position". This irrational status quo reflects historical inertias that even university authorities still jealously tend to maintain. With well-known exceptions, the academic promotions granted to women are more discussed, questioned and commented than those for men.

4. Women in Mexican Paleontology

As far as Paleontology is concerned in Mexico, there is no female contribution recorded in the nineteenth century; men made all the contributions within this field. Among the various factors of this delay are old common beliefs such as "it is a job considered only for men", or that "there are many dangers in the field", which supported a systematic discrimination based on sex. Likewise, the lack of infrastructure and the need for women at home were some of the factors in Mexico, and other countries, that prevented women from dedicating their work to Paleontology. Even today, some of these reasons perfectly explain why the presence of women in the Earth Sciences is scarce.

New research lines developed only until the second half of the 20th century under the umbrella of micropaleontology, a research area with a true root into the oil industry at the Instituto Mexicano del Petróleo. However, the real female paleontological contributions began with Dr. Gloria Alencáster Ybarra (1927-2018). This step was preceded by the ability and vision of Maldonado-Koerdell, who managed to open paleontological laboratories and official positions for women (Zamudio-Varela, 2012). Gloria Alencáster (Figs. 1a and f) began her paleontological research at the Instituto de Geología, UNAM, after obtaining her PhD in 1956. Soon after, Dr. Alicia Silva Pineda, a specialist in fossil plant impressions, and Dr. María Del Carmen Perrilliat Montoya, dedicated to Cretaceous mollusks, joined her team. Subsequently, more women integrated in this fascinating area: paleontologist Dr. Celestina González Arreola, a specialist in ammonites, and Dr. Blanca Estela Buitrón Sánchez, whose pioneer work in invertebrates and Paleozoic paleoenvironments continues to these days. The work and attitude of these influential scientists are considered as the steppingstone of Mexican Paleontology and were a breakthrough for other women interested in this discipline.

The creation of the Instituto Mexicano del Petróleo (IMP) in 1965, also represented an enormous opportunity for geologists, biologists and paleontologists to be incorporated within the field of Earth Sciences. Since the early days, they studied micro and macrofossils from different regions of Mexico on the occasion of oil exploration, when paleontology was seen only as a complementary research line. Of course, as any other basic science, paleontology has many practical applications, but its theoretical implications go beyond the economic aspects.

At the Instituto de Geología, UNAM, Professors Ana Luisa Carreño, Marisol Montellano Ballesteros, Socorro Lozano García and Ana Bertha Villaseñor Martínez, were part of the first generation of the Mexican pioneers that opened new research lines at the university (Figs. 1b-e). Other professors also started as graduate students at the Instituto de Geología at UNAM, and eventually became full-time researchers that incremented the specialization and diversification of Mexican paleontology; in some cases, at the same institute, but in most cases, the new paleontologists started to work as professionals in other UNAM campus and other higher educational institutions of Mexico.

Since the early days, an academic trajectory in paleontology has been actively promoted by UNAM professors, who always have included students in their research projects. The development of paleontology heavily relies on field work in constant interaction with theoretical research, activities that during the last three decades, have shown the increasing participation of women (Fig. 2).

Others former UNAM students derived from pioneer groups at the Instituto de Geología, are now full-time professors from state universities and other prestigious higher educational schools. Their sound preparation and scholastic level provide an excellent background for independent research and education. This academic seed has continuously produced new professionals and presently, many paleontologists prepared at UNAM form part of the academic staff of diverse institutions in Mexico. In turn, new generations of women work as full-time professionals of paleontology for the first time at the institutional level, and cultivate novel research areas. For example, a third generation of paleontologists have devoted her time to teaching and research, and more importantly, to the creation of research groups in paleobotany at the Faculty of Higher Studies (FES, UNAM) (Figs. 3a-b).

A special word must be dedicated to Dra. María Fernanda Campa Uranga, the first and for so many years the only women geologist in the exploration brigades of Petróleos Mexicanos (PEMEX). María Fernanda Campa was an exceptional professional whose geological contributions in tectonostratigraphy and geochronology of the Mesozoic volcanic sequences in central Mexico and Guerrero are widely known. Not only she used to work very closely with other paleontologists in field campaigns and scientific publications (Campa *et al.*, 2017), but she also discovered new fossiliferous localities (Campa *et al.*, 1974). An early Cretaceous ammonite, *Falciferella campae*, has been dedicated to Dra. María Fernanda Campa; this fossil ammonite constrained the reconstruction of the margin of the Guerrero-Morelos carbonate platform and the end of volcanic activity in the Teloloapan arc before the Albian (Monod *et al.*, 2000). Perhaps her more pervasive influence was the description of suspect terranes in the south of Mexico, as evidenced by her classical and highly quoted paper (Campa and Conney, 1983). She was also the first geoscience woman at the Autonomous University of Guerrero too; currently, a paleontologist woman is teaching at this University (Figs. 3c-d).

The life of Dra. María Fernanda Campa, better known as Chata Campa, was honorable in many ways: as an excellent field geologist that maintained a healthy collaboration between paleontology and geology; as an innovative

Figure 1. Mexican paleontologists. (a) Pioneer paleontologist Gloria Alencáster (b) Microplaoentologist Ana Luisa Carreño at her office in her classical blue coat. (c) Palynologist Socorro Lozano. (d) Ammonite specialist Ana Bertha Villaseñor. (e) Marisol Montellano during a field campaign. (f) Gloria Alencáster with her students Angélica Oviedo and Lourdes Omaña.

scientist that dared to argument and think outside the box, and as a brave scientist who dedicated herself to debate and instruct, in addition to teaching and research, about the 2013 Energy Reform at the Deputies Congress (http://www.hcnl.gob.mx/glmorena/2019/02/). Her academic and social trajectory was graciously complemented with her citizen conscience (15diarioTV, 2015). Such a lifetime commitment to science and citizenship clearly makes her an unforgettable scientist.

As time goes by, the participation of women in paleontology increases. The best example is the actual Paleontological Council (ConPal) from the Instituto Nacional de Antropología e Historia (INAH), formed by twelve members, seven of which are women (Fig. 4). Some of them also are the first women paleontologist at their state institutions.

Finally, the inclusion of paleontological topics in popular magazines, in which the authors are women, is escalating, and so is their outstanding contribution in academic events organized by the Sociedad Geológica Mexicana and the Sociedad Mexicana de Paleontología (SOMEXPAL), as well as the increment in the graduation rate of paleontologists. Today, new generations of paleontologists are in demand in higher education and government institutions around Mexico.

5. The academic life for women

Fortunately for women, times are changing, and today, there is a notable trend where we see a healthy balance of men and women in most university careers. Most importantly, women have finally the option to enroll at any university career they choose to, or to do whatever they want, at least by law and by universities policies in most countries. Of course, there are specific situations that obey more to family traditions or family prejudices than to a restricted access to higher education.

Naturally, there are some fields in science where women prevail over men, for instance, botany, palynology and micropaleontology. Concordantly, other research lines as vertebrate paleontology is frequently more populated by

Figure 2. (a) A field campaign in Santa Fe del Río in Michoacán, under the leadership of Vertebrate paleontologist Maria Luisa García Zepeda (UMSNH). (b) Paleontologist Elizabeth Chacón during a graduate field-trip to Viesca dunes under the leadership of Prof. Francisco González Medrano, better known as "Maestro Pancho Medrano" (UNAM, 2002). (c) Micropaleontologist Ana Luisa Carreño with her students at the Geology Institute, UNAM.

Figure 3. A feminine touch in geosciences. (a–b) Paleobotanists María Patricia Velasco de León and Erika Torres (FES, UNAM). (c) Geologist Dra. María Fernanda Campa, first chair of the University of Guerrero in Taxco, Mexico (picture taken by Alfredo Dominguez in 2019, and kindly provided by Santiago Alvarez) (d) Dra. Catalina Gómez, first paleontologist at the University of Guerrero, campus Taxco, Mexico.

Figure 4. Women at the Paleontology Council, by alphabetical order: a) M.C. Felisa Aguilar Arellano (INAH), b) Dra. Blanca Buitrón Sánchez (UNAM), c) Elena Centeno García (UNAM), d) Elizabeth Chacón Baca (UANL), e) Luisa García Zepeda (UMSNH), f) Rosalía Guerrero Arenas (UMAR), g) Angélica Oviedo (UACH).

men than women, at least within the Mexican Association of Paleontologists or SOMEXPAL (Chacón *et al.*, 2020). But it is clear that there are multiple determining factors and circumstances that come into play when young students face the life decision of pursuing a career in paleontology.

The number of enrolled students at UNAM during 2019 in the undergraduate and graduate programs in Geosciences is shown in Table 1, in which the number of women is lower than that of men in most cases.

Actually, the student statistics shown in Table 1 contrast with those for women in the academy, notably at higher academic positions. In Mexico and around the world, there are still multiple aspects of the social, political and academic life where women need to demonstrate more results and provide higher standards than men. But particularly in the academy, the inequality between men and women may be more difficult to perceive. The following samples illustrate a rather generalized situation in most universities of Mexico,

but they may be the case in other advanced or less developed countries as well (Table 2).

The national distinction of the Sistema Nacional de Investigadores (SNI) and promotions among Mexican universities uncovers a clear pattern of the academic distance between men and women (Figs. 5–8).

The above figures are representative of the inequality in higher education institutions as part of the academic staff, without considering other academic promotions. Other similar difficulties pave the female route to accomplish higher levels in the academic hierarchy. Men are expected to ask for promotions, but women instead, must be prepared for a personal and administrative battle under official male standards. Even today, it seems that a legitimate ambition is a personal male attribute, which may be not "appropriate" in women.

The former statistics from small or large organizations in Mexico and around the world, are just but a few examples of a long historical inequality. This disproportion is most evident in higher scholar categories, especially in decision-making positions (Pérez Sedeño *et al.*, 2018). Although the academic disparity between men and women is not as scandalous and palpable as the physical violence, women must transit their professional path in silence, and fight on a personal level for a fair university position. Carmen Albroch (1998) already dwelled into this inequality in the social perception. For instance, the personal life of unmarried woman is suspicious and judged, but it is graciously accepted in men; the scrutiny that society applies on women is not different in the academic life. As women, we all share stories about differences between men and women that are translated into social behaviors considered as "normal". After all, the university statistics confirm this type of academic tradition. A personal or technical mistake is judged with more severity in women than men; the same applies to social and civil conditions, or personal preferences.

Women in science continue to be underrepresented, underpaid and underemployed. This situation is clearly supported by the cold numbers of the scientific prestigious institutions of the 21st century. The National Researchers System of CONACyT (Sistema Nacional de Investigadores or SNI) indicates that women average approximately only the 36% of total SNIs beneficiaries. The National Academy (Academia Mexicana de Ciencias) and the National College (Conal) provide further cases. The struggle for a fair representation continues in order to achieve the insertion

Table 1. Academic staff in state universities. Number of students by genre at the in the Area of Earth Sciences Undergraduate and Graduate levels - UNAM during 2019–2020.

Faculties/ Degree's	Men	Women
Faculty of Sciences	1,204	919
Engineering Faculty	1,898	642
Faculty of Chemistry	657	808
Postgraduate		
Astrophysics	34	15
Engineering	385	146
Earth Sciences	38	25
Physical Sciences	74	15
Chemical Sciences	68	33
Biological Sciences	113	137
Marine Sciences and Limnology	34	41
Geography	17	21

Source: Statistical Agenda UNAM, 2020.

Table 2. Academic staff in the Autonomous University of Chihuahua Academic staff divided according to Faculty disciplines.

Discipline	Career	Women	Man
Earth Sciences	Engineering Geology	7	11
	Paleontology*	1	0
	Engineering in Mines and Metallurgy	3	7
	Engineering in Topography	4	8

*Paleontology is not a career at the UACH, but a subdiscipline. Source: Statistical Agenda UACH, 2020.

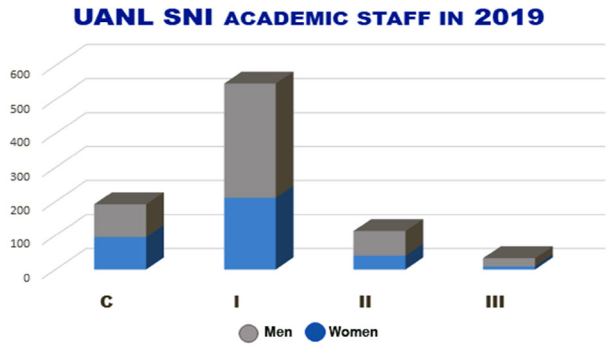

Figure 5. Women: Men ratio of the academic staff with the distinction from the Sistema Nacional de Investigadores (SNI) at the Autonomous University of Nuevo León (UANL). Source (www.uanl.mx); (hierarchy level in the SNI: C < I < II < III).

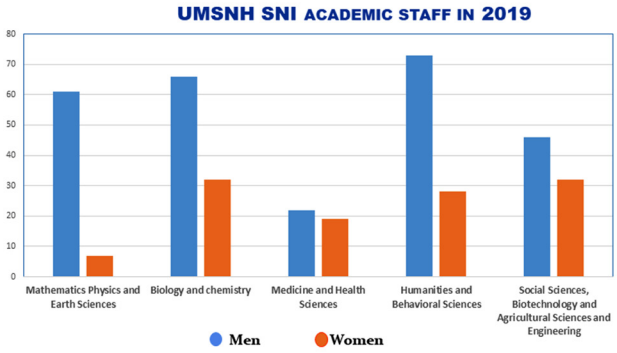

Figure 6. Women: men ratio of the academic staff distributed by area with the distinction from the Sistema Nacional de Investigadores (SNI) at the Universidad Michoacana de San Nicolás de Hidalgo (UMSNH).

of specialist women into a system developed under men´s rules and one-sided perspective (Lagarde, 1996).

6. A gender perspective, finally

The old black and white photographs illustrating the early days of geoscience in general, and paleontology in particular, still astonish us by the total absence of women, for so many years and in some many countries. We are not talking about any political movement or any other sociological given term, we are referring to the basic right to be treated and seen under the same light than men. The assumed antagonism between women and men is another misconception when women bring to the table an open talk of fairness and gender perspective; but there are social constructions that for centuries permeated the mentality of the whole society, including the academic world.

The historical development of paleontology in Mexico shows that an integral and multidisciplinary perspective among different areas of research is more fruitful than isolated, or individual approaches and shortsighted premises. As many areas of culture and society, there is an urgent need to support and promote a genre perspective. The institutional respect and appreciation for women involved in paleontology should comprise, not only their inclusion as students, but their advancement as well-paid professionals. The genre equality agenda has moved forward in this direction, but it is clear that our society is still behind, and that the "glass ceiling effect" in science is real and deeply affects collegiate life, even among the best-ranked universities.

Beyond the old-fashioned biological determinism in science that for centuries prevented the free access for women (Schiebinger, 1993), and apart from the legitimate right to be treated as equals in the academic world, the scientific evidence needs the feminine interpretation, not only a male-biased perspective. In fact, many of the scientific theories in paleontology are at risk because of this one-sided analysis (Abejez and Corona, 2020). Other scientific disciplines lack this neutrality as well, and therefore limit the production of a richer science (Schiebinger, 1993).

7. Conclusions

The current contribution shows a clear disproportion between men and women at the local, regional and national scholastic level. Science should be based on scientific results made by real persons and not based on traditional gender roles. Likewise, the profession should be based on academic achievements, where the recognition of intellectual merits and scientific creativity is independent of genre. It is not enough to obtain a balanced women representation in scientific or administrative positions, it is mandatory that any position in science is on competence and performance, where the same rules are equally applied for women and men, including benefits and rights.

The scientific endeavor that we call science, requires the participation of passionate women and men as equal partners with different and many times complementary perspectives. The female academic merits are not higher or lower than men, but they need to be analyzed under individual basis, using the same academic criteria and giving the same opportunities. One superb example of such a need has been eloquently expressed by the recently honored, Donna Strickland as she received the Nobel Prize for 55 years in Physics: "*I am not a science woman, I am a scientist*". Science is a collective activity that needs a concerted work of men and women working toward a better future, and a greater science.

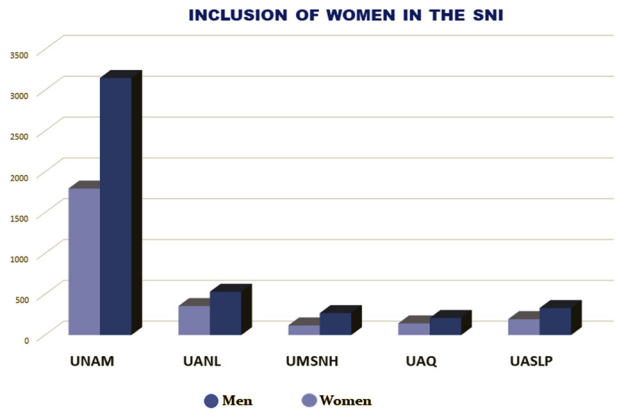

Figure 7. Comparison between men and women ascribed to the Sistema Nacional de Investigadores (SNI) from some higher Education Institutions in Mexico (source: www.conacyt.gob.mx).

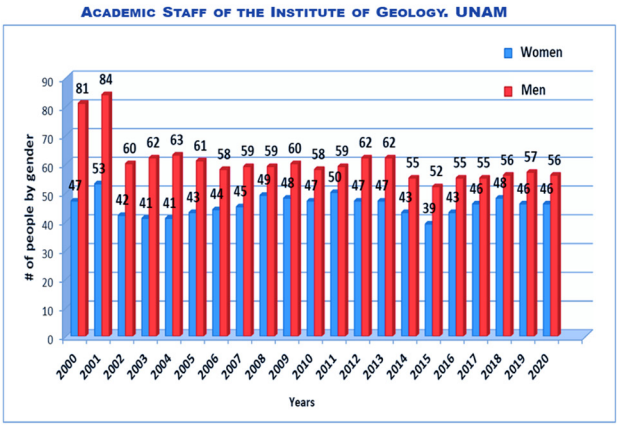

Figure 8. Academic Staff of the Institute of Geology, UNAM during the period 2000-2020. Source: Statistical Agenda UNAM, 2000-2020.

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References

Abejez, L.J., Corona, C., 2020, Feminismo y perspectiva de género en la Paleontología. [Feminism and gender perspective in Palaeontology]: Spanish Journal of Paleontology, 35(1), 29–46. DOI: https://ojs.uv.es/index.php/sjpalaeontology/article/view/17178

Academia Mexicana de Ciencias (AMC), *in* https://amc.edu.mx, consulted: November 20 of 2020.

Alborch, C., 1999, Solas: Barcelona, Planeta, 247 pp.

Alvarado, M.L., Becerril Guzmán, E., 2002, Mujeres y educación superior en el México del siglo XIX. Arranque de un proceso. Diccionario de Historia de la Educación en México. Proyecto CONACyT (in line) *in* http://biblioweb.tic.unam.mx/diccionario/htm/articulos/sec_10.htm, consulted: August 19 of 2020.

Arrom, S.M., 2019, La Güera Rodríguez: la construcción de una leyenda: Historia Mexicana, 69(2), 471–510. DOI: https://doi.org/10.24201/hm.v69i2.3972.

Campa, M.F., Campos, M., Flores, R., Oviedo, R., 1974, La secuencia Mesozoica vulcano-sedimentaria metamorfizada de Ixtapan de la Sal (Mex)-Teloloapan, Guerrero: Boletín de la Sociedad Geológica Mexicana, 35, 7–28. DOI: http://dx.doi.org/10.18268/BSGM1974v35n1a2

Campa, M.F., Ramírez, J., 1979, La Evolución Geológica y la Metalogénesis del Noroccidente de Guerrero: Universidad Autónoma de Guerrero, Serie Técnico-Científica 1, 84 pp.

Campa-Uranga, M.F., Coney, P.J., 1983, Tectono-Stratigraphic terranes and mineral resource distributions in Mexico: Canadian Journal of Earth Sciences, 20(6), 1040–1051. DOI: https://doi.org/10.1139/e83-094.

Campa-Uranga, M.F., García Hernández, C.U., Buitrón-Sánchez, B., Torres de León, R., 2017, Formación Chapolapa: El triásico que no era: Paleontología Mexicana, 6(1), 35–42. DOI: http://www.ojs-igl.unam.mx/index.php/Paleontologia/index.

Chacón-Baca, E., Velasco-de León, M.P., Castañeda-Posadas, C., Cuen-Romero, F.J., 2020, La Sociedad Mexicana de Paleontología: Una Retrospectiva Pertinente: Paleontología Mexicana, 9(1), 41–51. DOI: http://www.ojs-igl.unam.mx/index.php/Paleontologia/article/view/633/535

El Colegio Nacional (in line) *in* https://colnal.mx/, consulted: November 20 of 2020.

Creese, M.R.S., Creese, T., 1994, British Women Who Contributed to Research in the Geological Sciences in the Nineteenth Century: The British Journal for the History of Science, 27(1), 23–54. DOI: https://doi.org/10.1017/S0007087400031654

Gío-Argáez, F.R., Rodríguez-Arévalo, H.E., 2003, Panorama General de la Paleontología Mexicana: Ciencia Ergo Sum, 10(1), 85–95.

Gobierno de México, 2020, Datos abiertos: Consejo Nacional de Ciencia y Tecnología (CONACYT), Sistema Nacional de Investigadores (in line) *in* https://datos.gob.mx/busca/dataset/sistema-nacional-de-investigadores/ consulted: July 5 of 2020.

Kölbl-Ebert, M., 2012, Sketching rocks and landscape: Drawing as a female accomplishment in the service of geology: Earth Sciences History, 31(2), 270–286. DOI: www.jstor.org/stable/24138973.

Lagarde, M., 1996, Género y feminismo: desarrollo humano y democracia: Madrid, Horas y Horas, 248 pp.

López Ramos, E.,1988, Contribución a la Historia de la Geología en México: Boletín de la Sociedad Geológica Mexicana, 49(1–2), 3–18.

Lyons, S.L., 2009, Species, serpents, spirits, and skulls: Science at the margins in the Victorian age: Albany, State University of New York, 245 pp.

Mayor, A., 2000, The first fossil hunters: Dinosaurs, mammoths, and myth in Greek and Roman times: Princeton, N.J., Princeton University Press, 392 pp.

Mayor, A., 2005, Fossil legends of the first Americans: Princeton, N.J., Princeton University Press, 488 pp.

Monod, O., Busnardo, R., Guerrero-Suastegui, M., 2000, Late Albian ammonites from the carbonate cover of the Teloloapan arc volcanic rocks (Guerrero State, Mexico): Journal of South American Earth Sciences, 13(4–5), 377–388. DOI: https://doi.org/10.1016/S0895-9811(00)00030-4

Morales-Jurado, M.E., 2005, Las mujeres en la historia de México: de la independencia a la revolución: Ciudad de México, Universidad Pedagógica Nacional, Degree Thesis, 47 pp.

Montero, R., 1995, Historias de Mujeres: México, Alfaguara, 132 pp.

Pérez Sedeño, E., Kiczkowski, A., Márquez Pérez, I., 2018, A sociological study of gender and astronomy in Spain:Nature Astronomy, 2, 628–633. DOI: https://doi.org/10.1038/s41550-018-0509-x.

Sánchez, A.M., Tagueña, J., 2011, La primera geóloga mexicana: Revista Digital Universitaria, 12 (10), 1067–6079. DOI: http://www.revista.unam.mx/vol.12/num10/art91/art91.pdf

Schiebinger, L., 1993, Women in Science: Historical Perspectives *in* Urry, C.M., Danly, L., Sherbert L.E., Gonzaga S. (eds), Women at Work: A Meeting on the Status of Women in Astronomy: Proceedings of a workshop held at the Space Telescope Science Institute, Baltimore, Maryland, September 8–9, 1992, Baltimore: Space Telescope Science Institute (STScI), USA.

Séptimo Foro Reforma Energética. 3 junio 2008. 1 1ª parte cjg (in line) *in* www3.diputados.gob.mx, consulted November 20 of 2020.

Suárez Noyola, M.E., 2017, La Mujer universitaria y su aporte a la investigación científica en el Instituto de Geología, durante el periodo 2000–2013: Ciudad de México, Universidad Nacional Autónoma de México, Master Thesis, 218 pp.

Universidad Autónoma de Chihuahua, 2019, Estadística Básica: Administración 2016–2022: Chihuahua, UACH. 109 pp.

Universidad Autónoma de Nuevo León, 2020, Información Estadística UANL: Nuevo León, UANL, 26 pp.

Universidad Nacional Autónoma de México, Dirección General de Planeación, 2020, Agenda Estadística UNAM 2020 (in line) *in* https://www.planeacion.unam.mx/Agenda/2020/disco/ consulted: November 20, of 2020.

Zamudio-Varela, G., 2012, De fósiles, nombres y hombres: Un acercamiento al linaje de la paleontología mexicana: Paleontología Mexicana, 62, 4–10.

15 diario TV, 2015, Entrevista con María Fernanda Campa (video in line) *in* https://www.youtube.com/watch?v=fLqQGdU5Xg0, consulted: October of 2020.

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