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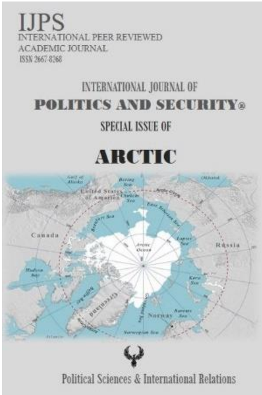

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Ozone Diplomacy, Ozone Regime Negotiations, and the Arctic

Sezai ÖZÇELİK*

Abstract

The most successful environmental regime negotiation was on the depletion of the ozone layer. As a result, it is necessary to briefly review the background of the ozone negotiations in terms of ozone science, agenda formation, and actors. This article follows the progression of ozone diplomacy over the decades, beginning with the 1985 Vienna Convention and leading to the 1987 Montreal Protocol and beyond. It also touches briefly on the effects of power and knowledge factors on ozone negotiations. The study analyzes how the ozone regime has adopted new scientific knowledge and has been transformed by transnational epistemic communities and coalitions. This brief assessment of ozone negotiation processes explains a balanced account of science and policy and their interaction shaping the development of the ozone regime.

Keywords: *Ozone Depletion, Ozone Hole, Arctic, Environmental Regime Negotiations, Environmental Diplomacy.*

Özet

En başarılı çevresel rejim görüşme örneği ozone tabakasının incelmesi ve delinmesi konusundadır. Sonuçta, ozon görüşmelerinin arka planında yer alan ozon bilimi, gündem oluşumu ve aktörlerin kısaca gözde geçirmek gerekmektedir. Bu makale 1985 Viyana Sözleşmesi ile başlayan ve 1987 Montreal Protokolü ve sonrası yaşanan gelişmelerle devam etmiş olan ozon diplomasisi takip etmektedir. Ayrıca kısaca güç ve bilgi faktörlerinin ozon görüşmeleri üzerindeki etkilerine değinilmiştir. Bu çalışma, yeni bilimsel bilgilerin nasıl benimsenerek ulus-ötesi epistemik topluluklar ve koalisyonlar tarafından ozon rejiminin nasıl dönüştürüldüğü analiz etmiştir. Ozon görüşme süreçlerinin kısa değerlendirilmesi yapılarak bilim ve politikanı dengeli çalışmasını açıklayarak ozon rejiminin gelişimini şekillendiren etkileşimleri açıklar.

Anahtar Kelimeler: *Ozon İncelmesi, Ozon Deliği, Arktik, Çevresel Rejim Görüşmeleri, Çevre Diplomasisi.*

1. Introduction

Over the last 30 years, there has been universal and unprecedented cooperation to protect the ozone layer. The possible relationship between anthropogenic chlorofluorocarbons (CFCs) and halon emissions, and the depletion of the stratospheric ozone layer have produced long processes of negotiation sessions to control ozone-depleting substances (ODSs).[1] At a meeting in Montreal, in September 1987, the “Protocol on Substances that Deplete the Ozone

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[1] Ozone depleted substances include chlorofluorocarbons (CFCs), halons, hydrochlorofluorocarbons (HCFCs), etc.

Layer" was signed by states and the European Community (EC) that are the parties to the 1985 Vienna Convention for the Protection of the Ozone Layer.[2]

Ozone Regime Negotiations concern two highly complex issues: the control of the emissions of ODSs and the creation of a developmental fund for developing countries in terms of financial aid and technology transfer. Emissions of the ODSs have come from CFCs and halons that have been used for air-conditioning, refrigeration, and fire extinguishing. There are only a few producers of ODSs, mainly the developed countries (the United States, European Union, Japan, Russia) and three major companies (DuPont in the United States, ICI in Great Britain, and HCI in France). Developing countries may have greater demand and a need for the increased production capacity of CFCs in the near future because their industrial and consumer production requires higher demands of ODSs for economic growth.

The Montreal Protocol was neither perfect nor complete, but an outstanding success story in the ozone negotiations. It was a compromise agreement in which each country gave and took at the final agreement. Two baskets of ODSs created eight substances for the control measures. The five CFCs (-11, -12, -113, -114, and -115) [3] comprised the first basket of ODSs. The second basket was composed of three halons (-1211, -1301, -2402).[4] CFCs were to be cut back in three stages, up to 50 percent of their 1986 production and consumption levels.[5] Halon production and consumption would be frozen within three years, except for essential uses. In Article 4 of the Montreal Protocol, trade restrictions may have been imposed against non-Parties. Developing countries received a concession to delay implementation of the control measures by ten years if their annual per capita consumption was less than 0.3kg per person. The scientific assessment provides a periodic review about further action every

[2] Sezai Özçelik, "Uluslararası Çevre Rejimleri ve Görüşmeleri Üzerine Kavramsal Bir İnceleme: Yapısalcı, Kurumsal, Bilişsel ve Görüşme Teorileri", *Eskişehir OsmanGazi Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi* 7, no 1 (2012): 231 – 250.
[3] Chlorofluorocarbons (CFCs) are a family of organic chemicals composed of chlorine, fluorine, and carbon atoms. CFCs had uses as refrigerants, fire extinguishing agents, solvents, propellants, foam blowing and process agents, feedstocks, pesticides, and product ingredients.
[4] A halon is a bromochloroflurocarbon, a chemical consisting of one or more carbon atoms surrounded by fluorine, chlorine, and bromine. Halons are fully halogenated hydrocarbons that are used as fire-extinguishing agents, explosion suppressants, and flooding enclosed spaces such as computer rooms and vaults. See. Edward A. Parson, *Protecting the Ozone Layer: Science and Technology*, (Oxford: Oxford University Press, 2003), 22.
[5] Pamela Chasek and Lynn M. Wagner, *The Road from Rio: Lessons Learned from Twenty Years of Multilateral Environmental Negotiations, Appendix: Summaries of Selected Multilateral Environmental Agreements*, (New York: RFF Press, 2012).

four years. As an innovative provision, two-thirds of the Parties could decide "adjustments" on the control measures based on further scientific assessment under Article 6.

Although the adoption of the Montreal Protocol marked the successful conclusion of reaching consensus on limits of ODSs, the Ozone Regime Negotiations have been continued through amendments where the Parties of Convention have re-convened in order to evaluate and re-negotiate the new limits of ODSs that arise with new scientific findings and contextual changes.

With the ratification of the Montreal Protocol by 184 countries, the ozone regime is an example of collaboration between scientists, governments, NGOs, media, and UN organizations. The industrialized countries almost completely phased out the ODSs. Consumption of CFCs by developing countries has also begun to decrease with the help of the Multilateral Fund. Although the maximum ozone depletion and the biggest ozone hole were recorded during 2000, the success of the ozone regime will make the Antarctic ozone hole disappear by the year 2050.[6]

Several previous studies have examined different aspects of the international ozone regime. The account of the ozone negotiation is important in understanding the relationship between scientific knowledge and political decision-making. The analytical framework of science-policy interaction can be tested with the simulation of one of the phases of the ozone negotiations. The ozone regime has sufficient substantive details of the interaction between the domains of politics and science. The detailed record of ozone negotiations allows us to explain what role politics and power play in determining negotiation outcomes and how scientific knowledge influences the policy decision-making process. The ozone issue has been strikingly important for its prominence of scientific arguments in policy debates and the interplay between scientific knowledge and power structures (symmetry and asymmetry). This research article is primarily about ozone regime negotiations that test knowledge and power factors. Ozone negotiations are incorporated into tracing the ozone regime formation. The researcher extensively analyzes an account of the ozone science, agenda formation, history of ozone diplomacy, the actors, and an evaluation of the ozone regime. The actors in

[6] Stephen O Andersen and K. Madhava Sarma, *Protecting the Ozone Layer: The United Nations History*, (Sterling, VA: Earthscan Publications, 2002), 345-346.

ozone regime negotiations are coalitions, Non-Governmental Organizations (NGOs), Inter-Governmental Organizations (IGOs), industry, and media.

The most successful environmental regime negotiation was on the depletion of the ozone layer. As a result, it is necessary to briefly review the background of the ozone negotiations in terms of ozone science, agenda formation, and actors. This article follows the progression of ozone diplomacy over the decades, beginning with the 1985 Vienna Convention and leading to the 1987 Montreal Protocol and beyond. It also touches briefly on the effects of power and knowledge factors on ozone negotiations. The study analyzes how the ozone regime has adopted new scientific knowledge and has been transformed by transnational epistemic communities and coalitions. This brief assessment of ozone negotiation processes explains a balanced account of science and policy and their interaction shaping the development of the ozone regime. This study first provides scientific background about the ozone problem. Second, it presents the agenda formation stage of the ozone regime negotiation. Third, it investigates two important ozone regime negotiation events, namely the 1985 Vienna Convention and 1987 Montreal Protocol. Fourth, different actors such as coalitions, NGOs, IGOs, Industry, and Media have played decisive roles in ozone regime negotiation. There are two important factors in ozone diplomacy. The structural factor and power as well as scientific consensual knowledge, and epistemic community are two central issues. The Arctic ozone hole is an important scientific turning point in ozone negotiation. The last part of the study focuses on the evaluation of ozone negotiation.

1.1. The Ozone Problem

Like many scientific words, the word "ozone" comes from the Greek word ozein, which means "to smell."[7] The discovery of stratospheric ozone and chlorofluorocarbons occurred almost at the same time. In 1930, Sydney Chapman hypothesized that the reaction of an oxygen molecule (O_2) to UV-light results in a split into two oxygen atoms (1). Then, when an oxygen atom (O) combines with an oxygen molecule, (O_2) it forms ozone (O_3) (2) (Grundmann, 2001, p. 34 and Andersen and Sarma, 2002, p. 9). Hence:

[7] Ian H. Rowlands, *The Politics of Global Atmospheric Change*, (Manchester: Manchester University Press, 1995), 43.

$UV + O_2 \rightarrow 2O$ (1)

$O + O_2 \rightarrow O_3$ (2)[8]

Almost at the same time in 1931, General Motors discovered a class of chemicals, called CFCs that have been widely used in refrigeration, air conditioning, and insulation because they are non-flammable, non-toxic, non-corrosive, noncarcinogenic, and stable.[9] Because of these favorable qualities, many industries have widely used these chemicals as a coolant in refrigeration and air conditioning (CFC-11 and CFC-12), as well as for mobile air conditioning (CFC-12); as a blowing agent in plastic foam and foam insulation (CFC-11 and CFC-12); in solvents for cleaning metal and electronic parts (CFC-113); as aerosol propellants (CFC-11 and CFC-12); and for fire extinguishing applications (halons).[10]

1.2. Agenda Formation

Scientists were the first to study the potential effect of supersonic transport (SST) on the ozone layer. Although most studies agreed on the negative impact of SST, they had different predictions as to the amount of depletion of stratospheric ozone. In 1974, Rowland-Molina hypothesized that CFC emissions might be damaging to the ozone layer by breaking down ozone molecules[11] With their estimated lifetime between 40 and 150 years, CFCs do not dissolve but rather accumulate and diffuse throughout the stratosphere. Rowland and Molina assumed a causal chain reaction that CFCs reach the stratosphere without dissolution; at which point then as UV light splits them; the strong negative attraction of the chlorine molecules binds with the weaker ozone molecules, breaking them apart the upper part of the stratosphere. The estimate of total stratospheric ozone reduction is between 7 and 13 percent in the period between 1974-1978.[12] Since the ozone layer cannot prevent harmful UV radiation from reaching the earth's surface, the depletion may cause an increase in skin cancer

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[8] Tora Skodvin, "The Ozone Regime", *Science and Politics in International Environmental Regimes: Between Integrity and Involvement*, eds. Steinar Andresen, Tora Skodvin, Arild Underdal, and Jorgen Wettestad, (Manchester: Manchester University Press, 2000), 122-125.

[9] Richard E. Benedick, "Protecting the Ozone Layer: New Directions in Diplomacy", *Preserving the Global Environment: The Challenge of Shared Leadership*, ed. Jessica Tuchman Matthews, (New York: W.W. Norton & Company, 1991), 120; Richard E. Benedick, *Ozone Diplomacy: New Directions in Safeguarding the Planet*, Enlarged Edition, (Cambridge, MA: Harvard University Press, 1998), 10; Peter M. Haas. "Introduction: Epistemic Communities and International Policy Coordination", *International Organization* 46, no.1 (1992): 11.

[10] Peter M. Haas, "Banning Chlorofluorocarbons: Epistemic Community Efforts to Protect Stratospheric Ozone", *International Organization* 46, no.1 (1992): 198.

[11] Benedick, "Ozone Diplomacy", 10.

[12] Dennis Hayes, "Highest Disregard", *Mother Jones* 14, no. 10 (1989): 36; Andersen and Sarma, "Protecting the Ozone", 10.

and eye cataracts and negative effects on plant and sea life. The global interconnection between the ozone layer and the health of whale populations has been demonstrated by showing a correlation in increases in UV/B radiation and negative effects on the DNA of whales swimming in Alaska.[13]

The Molina/Rowland hypothesis had wide-ranging effects on both scientific and political fronts. First, the US National Academy of Sciences (NAS) decided to convene a committee to analyze the quantity of ozone reduction. NAS estimates varied from 3 to 20 percent with a most likely level between 6 and 7.5 percent.[14] In contrast to the advocacy coalition for the limitation of CFCs and chlorine, the business and industry groups, particularly DuPont, the world's largest CFC manufacturer, challenged the ozone depletion hypothesis due to a lack of scientific evidence and consensus on the subject.[15] With the backing of several scientists and publishing organs, they stated that "the impact of CFCs on the ozone layer has been grossly overestimated."[16] DuPont alleged that the life span of CFCs in the atmosphere is only 10 to 20 years instead of 40 to 150 years.

After the first wave of scientific and political discussion on ozone depletion and the use of CFCs, decision-makers have acted for the domestic and international regulation of CFCs. In 1978, the United States and seven other countries namely Canada, Norway, Sweden, Denmark, Germany, Switzerland, and the Netherlands banned the use of CFCs in spray cans and aerosols for all but essential purposes and imposed a limit on the production of CFC-11 and CFC-12.[17]

At the international level, in May 1977, the United Nations Environmental Programme (UNEP) decided to establish the Coordinating Committee on the Ozone Layer (CCOL). The

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[13] For detailed effects of ozone depletion, please visit https://www.epa.gov/ozone-layer-protection/health-and-environmental-effects-ozone-layer-depletion.
[14] Asit K. Biswas, *The Ozone Layer: Proceedings of the Meeting of Experts Designated by Governments, Intergovernmental and Nongovernmenal Organizations on the Ozone Layer Organized by the United Nations Environment Programme in Washington D.C., 1-9 March 1977*, (Oxford: Pergamon Press, 1979), 144.
[15] Richard P. Mullin, "What Can Be Learned from DuPont and the Freon Ban: A Case Study", *Journal of Business Ethics* 40, no. 3 (2002): 207-218.
[16] Reiner Grundmann, *Transnational Environmental Policy: Reconstructing Ozone*, (New York: Routledge, 2001), 108.
[17] James K. Hammitt, "CFCs: A Look Across Two Continents", *Choosing Environmental Policy: Comparing Instruments and Outcomes in the United States and Europe*, eds. Winston Harrington, Richard D. Morgenstern and Thomas Sterner, (Washington D.C., USA: Resources for the Future, 2004), 159; Patrick Szell, "Negotiations on the Ozone Layer", *International Environmental Negotiation*, ed. Gunnar Sjostedt, (New York: Sage Publications, 1993), 32.

CCOL is composed of representatives from international governmental and non-governmental organizations.[18] At this time, both the scientific and decision-making communities had a range of strategies and an understanding of the problem. They warned about either the extremely serious future consequences or the possibility of a gross overreaction to the situation.

Nevertheless, UNEP decided to convene a global conference for the protection of the ozone layer. Negotiations on the framework convention began in January 1982. From the outset of the negotiations, three apparent camps were formed among the participating nations. The Toronto Group[19], led by the United States, aimed for an immediate global freeze on the production of CFCs 11 and 12 and a 30 percent reduction of consumption from the 1976 use levels of CFC-11 and CFC-12.[20] The United States was the world's largest producer and consumer of CFCs in 1987, consisting of 34 percent of global production and 29 percent of global consumption. The United States was the leader of large-scale reductions of ozone-harming substances together with the Toronto Group. The second-largest consumer is the European Community (EC) which accounted for approximately 20 percent of CFC global consumption and one-third of its production is exported in 1987.[21]

The European Union firmly advocated a production freeze at 1985 levels and only voluntary limits on uses in aerosols. They also believed that more scientific research and at the same time, compelling evidence was necessary for the total elimination of CFCs. According to their perspective, it was hard to replace nonflammable, nontoxic, inexpensive, and extremely useful chemicals without damaging their national industries and losing advantages of production and consumption of CFCs. In 1987, the EU consumed 20 percent of CFC production and one-third of its production went into exports. Developing countries, as the third group, accounted for 14 percent of global consumption.[22] Because they believed that CFC cutbacks would have negative effects on their development, they requested preferential provisions of financial assistance and technology transfer.

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[18] Pamela Chasek, *Earth Negotiations: Analyzing Thirty Years of Environmental Diplomacy*, (New York: United Nations University Press, 2001).
[19] The Toronto Group formed in 1983 and consisted of Canada, Finland, Norway, Sweden, Switzerland, and the United States (Benedick, 1998), 42.
[20] Robert V. Bartlett, Priya A. Kurian and Madhu Malik, *International Organizations and Environmental Policy*, (New York: Praeger, 1995), 59.
[21] Fen Osler Hampson and Michael Hart, *Multilateral Negotiations: Lessons from Arms Control, Trade, and the Environment*, (Baltimore, MD: John Hopkins University Press, 1995), 256.
[22] Benedick, "Protecting Ozone Layer", 117; Benedick, "Ozone Diplomacy", 26.

2. Ozone Diplomacy: Vienna Convention, Montreal Protocol, And Beyond

After eight negotiating sessions, many workshops, and the “intellectual leadership” of the UNEP’s Secretary Mostafa Tolba, the negotiating parties signed the “Convention for the Protection of the Ozone Layer” in Vienna, on 22 March 1985. At that conference, all parties reached the consensus that the ozone layer must be protected, but the convention contained non-specific obligations for protecting the ozone layer and general requirements for more research and the exchange of information. More than two years later, the parties agreed to the “Montreal Protocol on Substances That Deplete the Ozone Layer”, on 16 September 1987. The protocol provided “teeth” to the agreements by outlining specific control measures. The Protocol created a regime of control for several types of industrial chemicals that are harmful to the stratospheric ozone layer. All negotiation parties have reached a total ban on the production and use of CFCs and other ozone-depleting substances. Another important contribution was the principle of precaution that all parties decide to act preemptively before the clear scientific knowledge and evidence are presented and the principle of common and differentiated responsibility that created a fund to provide funding to developing countries to eliminate their dependency on the ozone-depleting substances.[23]

Two economic and environmental workshops were held in 1986 where the parties discussed “current and projected production, use and emissions of CFCs, current regulations and the cost and effect of such regulations, potential alternative technical options, and estimates of production, use, and emissions of substances other than the CFCs that could modify the ozone layer,”[24] The first meeting on a protocol on CFCs took place in December 1986 in Geneva. In this week-long event, two negotiating blocs, comprised of 19 industrialized countries and 6 developing countries presented their proposal.[25] The first group, the Toronto Group, proposed to fully reduce the consumption of CFCs by 95 percent, starting with a freeze and reduction by 20 percent, and 50 percent at intermediate levels within a reasonable time limit.[26] It defined consumption with this formula: production plus imports minus exports. Its proposal included conducting a scientific assessment periodically, adjusting the control measures, and banning exports of CFC technologies to non-parties. The second

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[23] Stanley Johnson, *UNEP: The First 40 Years*, (Nairobi: UNEP; 2012), 165.
[24] Andersen and Sarma, “Protecting the Ozone Layer”, 67.
[25] Chasek, “Earth Negotiations”, 105; Benedick, “Ozone Diplomacy”, 68-70.
[26]https://www.epa.gov/ozone-layer-protection/international-treaties-and-cooperation-about-protection-stratospheric-ozone.

group was the European Community (EC). Its proposal was based on a production cap at 1986 levels for CFC-11 and CFC-12, a review of control measures after the report of scientific experts, and a limitation of production on the developing countries that did not exceed their consumption in 1986. Another proposal was Canadian includes conduct a review of the production limit at least once every five years after a scientific report on the status of the ozone layer, provide technical assistance to the developing countries to help implementation of the Montreal Protocol, control on CFC-11, CFC-12, CFC-113, CFC-114, HCFC-22, methyl chloroform, halon 1301, halon 1211, and carbon tetrachloride. The third proposal was the Soviet Union which only control only on CFC-11 and CFC-12 production, conduct research for alternatives, and froze CFC production by the year 2000.[27]

The key questions at that stage of the negotiations were: which substances should be controlled; how should a periodic scientific assessment be organized; what is the special situation of developing countries; what are the issues on regulatory measures; and what are ample trade restrictions.[28] The third meeting of the negotiating group was held during 27-30 April 1987 in Geneva, where 22 developed and 11 developing countries, 3 industry, and 4 environmental organizations were present. It was a "breakthrough session" where UNEP Executive Director Mostafa Tolba used his intellectual leadership, the media and NGOs increased their interests on the ozone issue, the industry changed its position towards cooperation, and the scientific community almost reached a consensus on the depletion of the ozone layer.[29]

The Conference of the Plenipotentiaries convened to negotiate the Protocol on Substances That Deplete the Ozone Layer in Montreal for eight days in September 1987. Fifty-five countries, eleven industry organizations, six environmental NGOs, and six United Nations organizations and IGOs participated in the negotiations.[30] The final text was adopted in the early hours of the final morning when US and EC delegations met under the leadership of UNEP's director Tolba who succeeded in obtaining concessions from both parties for the last-minute agreement.[31]

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[27] Andersen and Sarma, "Protecting the Ozone Layer", 73.
[28] Mostafa K. Tolba and Iwona Rummel-Bulska, *Global Environmental Diplomacy: Negotiating Environmental Agreements for the World, 1973-1992*, (Cambridge, MA: MIT Press, 1998), 69.
[29] Parson, "Protecting the Ozone", 129-133.
[30] Andersen and Sarma, "Protecting the Ozone Layer", 84.
[31] Elizabeth R. DeSombre, *Global Environmenal Institutions*, 2nd ed., (New York: Routledge, 2017).

According to the Protocol, the states accepted the control of eight substances: five CFCs (CFC-11, CFC-12, CFC-113, CFC-114, and CFC-115) and three halons (1211, 1301, and 2402). Within three years, production and consumption of CFCs were to be cut back to 50 percent of their 1986 levels. Production and consumption of the halons would also be frozen for three years, except for essential use (such as for fire retardants).[32] Also, noteworthy is that the developing countries received exceptional treatment. They received a 10-year grace period until they would be required to adjust to the control measures. The Montreal Protocol entered into force on January 1, 1989. As of May 2003, the Protocol had been ratified by 184 parties.[33]

Although the Protocol was the most successful regime formation example, new scientific evidence required the strengthening of the protocol's control measures. In the second meeting of the Parties in London (1990), new amendments were added. In addition to completing the total phase-out of the five CFCs and the three halons by 2000, the meeting called for 10 additional halogenated CFCs and carbon tetrachloride to be eliminated by 2020.[34] Also, the London conference created a new fund to provide financial incentives and technology transfer for developing countries like Brazil, India, and China.[35]

In the fourth Meeting of the Parties in Copenhagen in 1992, the parties approved a new non-compliance procedure. It adopted a faster phase-out date for CFCs, (sped up to 1996) and halons (1994). A freeze on methyl bromide was decided but was only limited to developed countries. The partial phase-out of HCFCs was decided to begin in 2004 at 35 percent and the complete ban would be effective by 2030.[36] The Multilateral Fund was confirmed and became the permanent entity within the Executive Committee.[37]

On the tenth anniversary of the Protocol, the Parties met in Montreal for the ninth Meeting of the Parties. The 1997 Montreal Declarations announced a faster phase-out for

[32] U.S. Congress, Office of Technology Assessment, *Changing Degrees: Steps to Reduce Greenhouse Gases, OTA,-O-482*, (Washington D.C.: US Government Printing Office, 1991), 67.
[33] For the list of the countries, http://www.unep.org/ozone/Treaties_and_Ratification/2C_ratification.asp.
[34] Ruchi Anand, *International Environmental Justice: A North-South Dimension*, (Burlington, VT: Ashgate, 2004).
[35] Gareth Porter, Janet Welsh Brown and Pamela Chasek, *Global Environmental Politics*, 3rd ed, (Boulder: Westview Press, 2000), 90.
[36] N.K. Uberoi, *Environmental Management*, 2nd ed ., (New Delhi: Excel Books, 2003), 120.
[37] Neil Carter, *The Politics of the Environment: Ideas, Activism, Policy*, 2nd ed., (Cambridge: Cambridge University Press, 2011), 246-247.

methyl bromide. Baseline production was set at 1995-1997 averages for Article 5 Parties (developing countries). The parties approved setting up a licensing system for the trade of new, used, or recycled substances[38] (Andersen and Sarma, 2002, pp. 167-170 and Chasek, 2001a, pp. 108-109).

In 1999, the Parties adopted the Beijing amendment at the eleventh meeting that required that industrialized countries freeze production of HCFCs from 2004 to 1989 production levels.[39] The production baseline for the developing countries was set at 15 percent to meet their "basic domestic needs." The Multilateral Fund replenished to a total of US $440 million.[40] and Andersen and Sarma, 2002, p. 175).

3. Actors: Coalitions, NGOs, IGOs, Industry, and Media

In Ozone Regime Negotiations, the main issues have revolved around the scientific un/certainty and the detrimental effects of the control of ODSs on countries' economic growth in terms of the "abatement costs and loss of jobs." (Spring and Vaahtoranta, 1998, p. 14). Another factor that determines whether a state advocates stringent control measures or prevents any drastic reductions in the production and consumption of CFCs is "ecological vulnerability." The researchers classified the countries into four categories based on two unit-level factors: ecological vulnerability and economic costs.[41] Ecological vulnerability is defined as a country that may experience high and low-level effects from environmental problems. It may have a different degree of economic capacity to bear the "abatement costs."[42] If the country has low vulnerability and high-cost indicators, they become "draggers" that oppose international regulations. If they have high vulnerability and low-cost indicators, their position is that for stringent regulation as "pushers." The other two combinations of vulnerability and cost indicators are "bystanders" (low vulnerability and low costs) and "intermediates" (high vulnerability and high costs).

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[38] UNEP,UNEP İN 2002, 1, https://wedocs.unep.org/bitstream/handle/20.500.11822/8556/UNEP_Annual_Report_2002.pdf.

[39] Osamu Yoshida, *The International Legal Regime for the Protection of the Stratospheric Ozone Layer*, (Netherlands: Brill Nijhoff, 2018), 139.

[40] For further information, please visit Earth Negotiation Bulletin 19, no. 6 (1999), http://www.iisd.ca/vol19/enb1906e.html.

[41] Detlef Sprinz and T. Vaahtoranta, "The Interest-Based Explanation for International Air Pollution Control", *The Politics of International Environmental Management*, ed. Arild Underdal, (Boston: Kluwer Academic Publishers,1998), 14.

[42] Peter M. Haas, "Stratospheric Ozone: Regime Formation in Stages", *Polar Politics: Creating International Environmental Regimes*, eds. Oran R. Young and Gail Osherenko, (Ithaca: Cornell University Press, 1993), 152-185.

In the Ozone Negotiations, the Toronto Group essentially played the role of "pushers"[43] or "drivers"[44] to build the "minimum winning coalition" by either convincing "conductors" or "cruisers" to join their coalitions or weakening the "blocking coalition" or "laggard states /"draggers"[45]The "conductors" and "cruisers" (bystanders and intermediates) had either little or no interest to end the negotiations with successful outcomes. They could shift from one coalition to the next because their ecological vulnerability and economic interests could change through a cost-benefit analysis or other negotiation factors.

The "blocking coalition" included "defenders" that struggled for the resolution of a particular issue rather than the overall package of the agreement and "breakers" that opposed stringent environmental regulation. In the Ozone Negotiations, pushers states were Canada, the Nordic countries, and the United States. The big EC members (France, Italy, and the United Kingdom), Japan, and the Soviet Union were "dragger states."[46]

The main coalitions emerged during the working session in January 1985. Although the European Community members had different positions, the EC views were reflected in four big states (France, Italy, Germany, and the UK). The EC first proposed modest measures, such as periodic scientific assessments, a production-capacity cap of CFCs, and a 30 percent aerosol production cut. The Toronto Group advocated the "multi-option" approach with a total reduction of CFCs by 35 to 50 percent. The EC announced its new policy in 1987, which was a freeze on the production of CFCs and a 20 percent reduction of CFCs on 1986 levels. Also, the Toronto Group agreed with a 70 percent aerosol production cut. The Toronto Group proposal was focused on consumption controls while the EC was active on pushing for production controls.[47]

The developing countries entered the negotiation process just before the Protocol. They achieved a ten-year grace period on the use and production of CFCs and halons. They

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[43] Banu Bayramoğlu, *Ecological Threats and International Cooperation for A Common Future: The Case of Ozone Depletion*, (Unpublished M.A. Thesis, Bilkent University, 1993), 59.

[44] Gunnar Sjostedt, "Issue Clarification and the Role of Consensual Knowledge in the UNCED Process", *Negotiating International Regimes: Lessons Learned From the United Nations Conference on Environment and Development (UNCED)*, eds. Bertram I. Spector, Gunnar Sjostedt and William Zartman, (London: Graham Trotman/Martinus Nijhoff, 1994), 74.

[45] Marvin S. Soroos and Lev Markovich Soroko, *The Endangered Atmosphere: Preserving a Global Commons*, (Columbia: University of South Carolina Press, 1997), 270.

[46] Oran R. Young, "The Politics of International Regime Formation: Managing Natural Resources and the Environment", *International Environmental Governance*, ed. Peter M. Haas , (New York: Routledge, 2016), 91.

[47] Parson, "Protecting the Ozone", 120.

wanted an agreement that addressed their developmental issues and the principle of equity, since industrialized countries have 25 percent of the world's population and 85 percent of the consumption of CFCs. To maintain their standard of living and economic growth, they requested additional technical and financial assistance to implement the Protocol's obligation. They had high stakes in the negotiation outcome. First, they were vulnerable to health risks due to ozone depletion. They had poorer health care systems. Also, the effects of loss on agricultural and fishery production loss may have hurt them more because poverty and food shortages were already problems.

The degree of institutionalization of the Ozone Negotiations was related to the role of intergovernmental organizations, especially the UNEP. The UNEP had procedural power to set the agenda, organize the technical, scientific, economic workshops, disseminate the scientific knowledge, give administrative and secretarial support, and break deadlocks by backroom maneuvering and individual leadership of its director, Tolba. Other international and domestic IGOs have played different roles in different stages of the negotiations. For example, the British Antarctic Survey (BAS) announced an abnormally low Antarctic ozone – 30-40 percent depletion in May 1985.[48]

Media coverage played an important role in "public agenda-setting" for different interest groups to transmit their positions on the ozone issue to the public. Environmental NGOs, as "shapers of policy", attended the negotiations as observers and interveners; they became advocates for technological change, cooperated with industry and governments, and served as "watchdogs" on the implementations of the Montreal Protocol by signatories.

3.1. Structural Factors: Power

The most important structural factor in the Ozone Negotiations is power, especially economic power. The leadership role of the United States since the early 1980s produced a strong regime in the protection of the ozone layer by using its economic muscle, positive and negative incentives (carrots and sticks), and the threat potential. The turning point in the agenda formation occurred when the Toronto Group successfully placed global control of CFCs used in aerosols. The United States could have achieved this since they had begun to

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[48] Owen Greene, "The System for Implementation Review in the Ozone Regime", *The Implementation and Effectiveness of International Environmental Commitments: Theory and Practice*, eds. David G. Victor, Kal Raustiala, and Eugene B. Skolnikoff, (Cambridge: MIT Press, 1998), 89-136.

reduce their share of aerosol propellants from 49 percent in 1973 to 29 percent in 1977.[49] This early move created an economically advantageous situation for the United States and its allies in 1978 since their industry had already begun to develop alternative technologies and substitute chemicals. Also, a global ban just confirmed their domestic regulations and created a competitive advantage in export markets against the European companies.

Another positive turning point happened when DuPont changed its position in September 1986. It is accepted that both the Antarctic ozone hole and global ozone reduction results from the use of CFCs. Although the replacement of old technologies could impose some costs on the company, the objective of the company was to avoid a negative image and reputation in the media and legal proceedings in case of claims of skin cancer. Since the production of CFCs represented a small portion of the company's portfolio, it was better to avoid bad press and consumer boycotts. The study of the Environmental Protection Agency (EPA) in late 1986 estimated that 40 million cases of skin cancer and 800,000 cancer deaths were expected in the USA in the next 88 years due to the thinning of the ozone layer.[50]

The bargaining position of the United States was defined as aggressive leadership for strong controls. First, U.S. negotiating teams have worked for an operational global agreement. They provided crucial scientific data and assessment, especially the National Aeronautics and Space Agency (NASA). Second, Congress threatened to take unilateral action on the control of CFCs and impose trade sanctions on non-compliance countries. Third, the U.S. industry changed its position on developing alternatives of CFCs.[51]

4. Scientific Consensual Knowledge, Epistemic Communities and Ozone Hole in the Arctic

In the analysis of the Ozone Negotiations, many scholars believe that scientific consensus played a major role in all phases of ozone diplomacy. Ozone science cannot, alone, be sufficient to have an impact on the negotiation process. The link and communication between scientific and policy communities require the existence of epistemic communities

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[49] Lynne M. Jurgielewicz, *Global Environmental Change and International Law: Prospects for Progress in the Legal Order*, (Lanham: University Press of America, 1996), 165-186.

[50] Jorgen Wettestad, "The Vienna Convention and Montreal Protocol on Ozone-Layer Depletion", *Environmental Regime Effectiveness: Confronting Theory with Evidence*, eds. Edward L Miles, et.al., (Cambridge, MA: MIT Press, 2002), 149-172.

[51] Srini Sitaraman, "Evolution of the Ozone Regime: Local, National, and International Influences", *The Environment, International Relations and U.S. Foreign Policy*, ed. Paul G. Harris, (Washington D.C.: Georgetown University Press, 2001), 114-120.

and institutional arrangements (Skodvin, 2000b). During the negotiation process, science produced new knowledge, and then uncertainty was reduced. In the ozone case, the national (EPA, NASA) and international (WMO, UNEP) scientific organizations sponsored scientific research and published scientific assessment reports. Also, the scientific "smoking gun" like the Antarctic ozone hole played a catalyst role to awaken public opinion and induce the decision-makers to take immediate and precautionary action. The institutionalization process made science-policy interaction and dialogue possible with semi-formal workshops and collaboration.

It was claimed that the importance of science is a "myth" since scientific knowledge was far from consensual and decisive at the time of the Kyoto Conference (1987).[52] Besides, a breakthrough in developing CFC alternatives is also a myth. The ozone depletion reactions mostly occur under certain conditions in the stratosphere. These conditions are extreme cold, isolation, and darkness, and exposure to sunlight when after the long polar winter's first spring sun appears. Antarctica is the worst affected area, probably because air is most isolated from the rest of the atmosphere. Scientists call the ozone hole where ozone is most depleted in the atmosphere and there is less ozone than anywhere. There was no *significant* scientific advance in two main research areas: the causes of global ozone destruction (the role of CFCs on the ozone loss) and the Antarctic ozone hole (italics added).[53] The Antarctic ozone hole is the area of the Antarctic stratosphere in which the ozone levels in the 1990s have dropped as low as 33 percent of their pre-1975 values.[54] The ozone hole occurred during the Antarctic spring, from September to early December when strong western winds begin to circulate the continent and create an atmospheric container.

In the winter of 2005, the Arctic was excessively cold in the stratosphere. Polar Stratospheric Clouds were plentiful over high-latitude areas until a big warming event, which begun in the upper stratosphere during February and circulated throughout the Arctic stratosphere in March. The low level of ozone in 2004-2005 was much higher than in any year since 1997. The reason is based on the very low stratospheric temperatures and

[52] Parson, "Protecting the Ozone", 248.
[53] Grundmann, "Transnational Environmental".
[54] Shagoon Tabin, *Global Warming: The Effects of Ozone Depletion*, (New Delhi: A.P.H. Publishing Corporation, 2008), 77.

meteorological events that created favorable conditions for ozone destruction together with the increasing amount of ozone-depleting chemicals in the stratosphere.[55]

In the 1990s, the ozone hole has been occurred not only in Antarctica but also in the Arctic. The Arctic ozone hole has been reached in Britain in March 1996 where is the deepest ozone hole in the Northern Hemisphere. The ozone depletion over the northern hemisphere has been increased steadily from the winter of 1992 for two reasons: Ozone-depleting chemicals and the extremely cold temperature in the Arctic stratosphere where polar stratospheric clouds are formed. During 2010-2011, a persistent and unusually strong polar vortex formed over the Arctic that has not been seen in the last 30 years or so. [56]

The major difference between the Arctic and Antarctic ozone hole is that the Arctic has a more disturbing stratospheric circulation. The reason is that the wind near the surface in the Arctic is affected by land-sea contrast and mountains. The atmospheric changes vortex and weakens it. Downward motion and accumulation of ozone warm of the atmosphere. Each spring in the Arctic, chlorine, and bromine plus sunlight destroy ozone. As the winter progress, stratospheric motions move ozone downward over the Arctic, resulting in a maximum over the pole. In the spring, Chlorine monoxide (CIO) has also built up in the Arctic. When the sun comes up, the CIO begins to destroy ozone. Thus, springtime ozone in some regions in the Arctic has a maximum level of ozone loss.[57]

5. Evaluation of the Ozone Negotiations

Ozone Regime Negotiations have presented a striking example of regime formation in the presence of a different power configuration. Also, it is a rare case where science drives politics. In two decades of negotiations over ozone depletion, power relations and scientific/consensual knowledge have played key roles in the creation of the ozone regime.[58]

[55] Shagoon "Global Warming", 69.
[56] S.A. Abbasi and Tasneem Abbasi, *Ozone Hole: Past, Present, Future*, (New York: Springer, 2017), 106-108.
[57] Richard S. Stolarski, "Ozone Depletion", *World Atlas of Atmospheric Pollution*, ed. Ranjeet S. Sokhi, (London: Anthem Press, 2008), 71.
[58] Sezai Özçelik, "Uluslararası Çevre Rejimleri ve Aktörler: Devletler, Hükümet-Dışı Aktörler, Uluslararası Örgütler, Uluslararası Sivil Toplum Kuruluşları ve Çok Uluslu Şirketler", *Uluslararası Çevre Rejimleri,* der. Gökhan Orhan, Semra Cerit Mazlum ve Yasemin Kaya, (Bursa: Dora Yayınları, 2017), 31-67.

In the ozone-regime case, the Convention, the Protocol, and the Amendments[59] laid down a set of principles, norms, rules, and procedures concerning the other environmental and cross-sectoral regimes. In the ozone regime, we can identify *principles* such as the abatement and prevention of pollution inputs into the stratospheric ozone layer. Second, any reduction must not result in a shift toward other pollutants and other environmental settings. The *norms* of this regime can be defined in a more straight forward manner: (1) participant states are obligated to reduce the ozone-depleted substances such as chlorofluorocarbons (CFCs), hydrochlorofluorocarbon (HCFC), and halons; (2) the parties agreed to improve their scientific cooperation and to share new information; (3) it was agreed that developed countries create a funding mechanism and transfer new technologies to help the developing countries implement the agreements. These norms are specified through several *rules* defining the coverage of ozone-depleted substances and the making of precise prescriptions for base and target years, and the size of the cuts. Procedures for verifying compliance with these prescriptions were established as well.[60]

The researchers listed six factors that were conducive for the success of the ozone regime:

1. the impact of scientific understanding of ozone depletion;
2. the role of the epistemic communities;
3. the impact of public pressure on decision-makers;
4. the role of technological developments;
5. the leadership role played by the United Nations; and
6. the role of international institutions.[61]

First, the formation and maintenance of regimes require the existence of an asymmetrical distribution of power in a given issue area so that all actors can benefit from joint gains with the supply of the collective goods in the international system. Some scholars argue that the dominance of the United States in scientific research, diplomatic competence, and production and consumption of chlorofluorocarbons (CFCs) created a success story in the

[59] Vienna Convention for the Protection of the Ozone Layer (1985), Montreal Protocol on Substances that Deplete the Ozone Layer (1987), the 1990 London Amendment, 1992 Copenhagen Amendment, 1997 Montreal Amendment, and 1999 Beijing Amendment.
[60] EPA, EPA Strategic Plan: 2003-2008-Direction for the Future, (2003), 20. https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=100048XS.TXT.
[61] Sprinz and Vaahtoranta, "The Interest-Based, 18.

Ozone Regime Negotiations. The ozone regime was shaped by the United States, despite the opposition of the European Community for CFC production control.[62] Second, the discovery of the ozone hole together with the unexpected increase in CFC use created a shock wave both in the public and political spheres during a sense of urgency for stringent control mechanisms. Scientific knowledge played a large role in bringing about political compromise. Third, the role of political and individual leadership helped to solve the stalemate and created turning points throughout negotiation sessions. Also, if a country has a higher ecological vulnerability and lower abatement costs, it becomes a "pusher" that has a strong preference to regulate ozone-depleting substances. The researcher emphasized the importance of international institutions – the UNEP – and the high involvement of media and public concerns.[63]

It is possible to list some reasons why the ozone regime was successful. The first reason is that the ozone issue was relatively easier to solve than other environmental issues, like climate change or biodiversity, and is a more serious global challenge.[64] Second, the governments accepted the norm of "precautionary measures" instead of a "wait and see" approach, which advocated that complete scientific certainty confirm the link between the ODSs and ozone depletion. Third, the parties developed a "common but differentiated responsibility" policy that all countries have a responsibility to protect the ozone layer, but that developed countries have more responsibility since they have caused more emissions and damage.[65] The third reason was the role of UNEP that promoted "informal consultations and working group meetings."[66] Fourth, there was a partnership between science and technology such that the scientific assessment was a decisive factor in the complete phase-out of CFCs. The discovery of the Antarctic and Arctic ozone holes created momentum for the Montreal Protocol by linking the ozone hole with CFCs production use. The media played an enormous

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[62] Peter M. Haas, "Epistemic Communities and the Dynamics of International Environmental Cooperation", *Regime Theory and International Relations*, ed. Volker Rittberger, (Oxford: Clarendon Press, 1993), 182.
[63] Pamela Chasek, "Lessons Learned in Multilateral Environmental Negotiations", *Improving Global Environmental Governance: Best Practices for the Architecture and Agency*, eds. Noricha Kanie, Steinar Andresen and Peter M. Haas, (New York: Routledge, 2014): 60-64.
[64] Sezai Özçelik ve Ayşe Dilek Öğretir, " The Universiy Students Understanding and Perceptions of the Climate Change or Global Warming: Survey Results", *Akdeniz University, 4th International, International Relations Congress Department of International Relations, 'Features of Current International Relations'*, (2017).
[65] Sezai Özçelik, "Climate Change Negotiations Positions of the United States, the European Union, and G-77/China before and after the Kyoto Treaty: 1995-2002", *Enerji ve Diplomasi Dergisi* 1, sy. 2 (2015): 34-60.
[66] H. Stevenson and J. S. Dryzek, *Democratizing Global Climate Governance*, (Cambridge: Cambridge University Press, 2014): 74.

role in publicizing the issue, the NGOs pressured the world community, and public opinion motivated the governments and industry.[67]

During the ozone regime negotiations, the validity of generalization of the importance of "scientific knowledge and technological breakthrough" is challenged. But environmental treaty secretariats such as UNFCCC have served as the institutional memory of environmental regimes. In addition, secretariat staff possesses expert technical and scientific knowledge about the environmental problem, have administrative and procedural knowledge of regime rules, norms, and operations, and present diplomatic knowledge of state preferences. As "knowledge brokers", they are instrumental for dealing with the complex interlinkages characteristic of international environmental regimes.[68]

The Ozone Secretariat created the 1987 Montreal Protocol with the "science-driven" decisive advance in scientific understanding. The widespread understanding was that new knowledge led to a successful negotiation outcome - that the risks of inaction outweighed the costs of action since the "knowledge brokers" framed the causal mechanisms of scientific knowledge to advise powerful political leaders and diplomat-negotiators. It is highlighted that no significant changes happened in scientific debate when the ozone hole was discovered after the Montreal Protocol. The scientific research and "epistemic communities" were far from diminishing "new questions, uncertainties, and discrepancies between theory and observations" on the ozone loss. Although he admitted that the ozone hole had been a factor in the 1987 Protocol, its effects on the negotiation were limited and less prominent since "policymakers agreed widely that this strong suspicion was not enough to support stringent controls."[69]

The "authoritative scientific assessment" confirmed for policymakers the scientific claim that CFC production/use was growing and that large ozone losses would be possible if growth continued. With that scientific knowledge, the assessment influenced the negotiation outcome by limiting the bargaining range of proposals. İt is argued that that scientific assessment excludes the negotiation position of "unrestricted CFC growth" and weakens the

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[67] Pamela S. Chasek, David L. Downie and Janet Welsh Brown, "Ozone Depletion", *The Globalization Reader*, eds. Frank J. Lechner and John Boli, (West Sussex, UK: John Wiley&Sons, 2015), 527-529.
[68] Pamela S. Chasek, David L. Downie and Janet Welsh Brown, *Global Environmental Politics*, 7th ed., (New York: Routledge, 2018), 75.
[69] Robert Falkner, *Business Power and Conflict in International Environmental Politics*, (New York: Palgrave, 2008), 71.

position of the industry and the European Community (EC). For example, DuPont rapidly changed its position and announced the endorsement of the global phaseout of CFCs and the immediate freeze in production of CFCs.[70]

6. Conclusion

This research article highlights the general view of environmental regime negotiations, explains the scientific background of the ozone issue, provides an instructive record on the history of the Ozone Negotiations with the major actors and issues, and reviews different discussions on the lessons from the development of the Protocol. It is a balanced account of science, policy, and history and their interactions in shaping the outcome of the ozone regime. The success of the Ozone Negotiations results from the extraordinary cooperation of governments, scientists, NGOs, industry, media, and UN organizations.

The ozone regime was established on two principles: the global emissions of ozone-damaging chemicals are regulated by global actors to protect the ozone layer and the protection of the ozone layer requires international cooperation by including all areas, actors, and issues. The consensual knowledge including scientific, technical, economic, and ecological knowledge has played a crucial role in the creation of principles, norms, rules, decision-making procedures to reduce ozone-destroying chemicals.

The ozone depletion has been perceived as the most salient environmental issue during the 1990s. The issue of the Arctic ozone hole was a threat to not only the North but also the whole planet. Unlike the climate change negotiations, the United States has played the lead role and become a pusher by imposing comparatively the most strict regulations about the ozone-depleting substances such as CFCs and halons. The United States has had a huge opportunity to benefit from the international restrictions on the production and use of CFCs because the American industries had an advantageous position in the development, production, and marketing of the CFC substitutes. In addition, the White House had the potential to manipulate other countries' preferences especially developing countries. It had a willingness to bear the burden on the ozone regime.[71]

[70] Parson, "Protecting the Ozone", 248.
[71] Sezai Özçelik, "Çevresel Rejimler", *Çevre Hukuku ve Politikaları: Kavramlar, Teoriler ve Tartışmalar,* ed. Zerrin Savaşan v.d., (Ankara: Seçkin Yayınevi, 2021), 157-186.

The ozone negotiations have also shown the importance of consensual knowledge and epistemic community. The discovery of the ozone hole over the Arctic had a push factor only for scientists but also for the policy-makers. The ozone layer the size of North America was destroyed over the Arctic. The discovery of the ozone hole was almost blind luck. The U.S. space satellites have routinely surveyed ozone levels, but the data was just collected and filed. Later, computers were programmed to find the ozone losses. In addition, the British Antarctic Survey and a Japanese expedition have collected ozone data from the ground. During the 1970s, all scientific analyses found a sudden and unexpected drop in the ozone level. In December 1985, both Antarctic and Arctic holes were made public. After two scientific expeditions, it was found in spring 1988 that chrolines and Freons were the causes of the ozone depletion chemistry reactions. In the same year, the ozone negotiation has resulted in the Montreal Protocol in September 1987 that targeted a worldwide reduction in the use of ozone-depleting chemicals within 10 years. The protocol regulated eight specific chemicals that destroy ozone, five CFCs (11, 12, 113, 114 and 115) and three halons (1211, 1301, and 2402). As a result, it forecasted that both Antarctic and Arctic ozone holes disappear in less than a century. There is a consensus that chlorine from CFCs is a major contributor to the Arctic ozone decreases. All actors and stakeholders namely governments, industry and scientific community have agreed on taking protective measures. The industry was aggressively developed substitutes for the CFCs to achieve a long-term reduction in atmospheric chlorine. After the US leadership, the 12-member European Community, Japan and the Soviet Union, which together accounted for nearly two-thirds of the world production of ozone-depleting substances joined the protocol’s strict non-compliance procedures that demonstrated the ozone regime’s effectiveness and resilience. The ozone negotiation has been a long process with negotiating sessions, expert panels on science, technology, and economics, committee meeting about financial aid, implementation and non-compliance issues. The success of the ozone regime negotiation has led to the 1992 UN Conference on Environment and Development/Earth Summit (UNCED) in Rio de Janeiro and the 1994 International Conference on Population and Development in Cairo. The lessons learned from the ozone experience have opened the way for the climate change negations on the Framework Convention on Climate Change (FCCC). The model of ozone diplomacy provides a valuable precedent to overcome scientific uncertainty and long terms and risks and increase multilateral cooperation and international consensus in scientific, economic, and political issues. President Reagan summarized the success of the ozone regime during the signing ceremony of the U.S. ratification in April 1988: "An extraordinary process of scientific study… and the international community may well prove to be a paradigm for a new form of global diplomacy.[72]

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[72] Benedick, The Ozone, 8.

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