André Weil (1906–1998)

Armand Borel, Pierre Cartier, Komaravolu Chandrasekharan, Shiing-Shen Chern, and Shokichi Iyanaga

Shiing-Shen Chern

I believe Weil and I first met in Paris in the fall of 1936 at the Julia seminar "Sur les travaux scientifiques de M. Élie Cartan". He soon went to Princeton, and I must have left no impression on him.

Our first scientific encounter came when he wrote in the newly started *Mathematical Reviews* a lengthy review of a short article of mine on integral geometry. Although he was somewhat critical, he generally liked my paper.

We first really met in the fall of 1943 when I came to the Institute for Advanced Study and he was teaching at Lehigh University and we became good friends. At that time he had just published his proof of the high-dimensional Gauss-Bonnet formula. But our common mathematical interest goes over the whole of mathematics, and I was always impressed by his vast knowledge and judgment.

We soon became colleagues at the University of Chicago in 1949–59 during the Stone period. Under Stone's leadership Chicago became an active mathematical center with excellent students. We had constant contact and took long walks along the south coast of Lake Michigan when it was still safe.

Weil was known as a leader of the Bourbaki group. This started when a group of young French mathematicians planned to introduce modern mathematics to France. It was an extremely talented group. Among their plans was the compilation of a book where all the theorems had complete and rigorous proofs. It is difficult to make success of such a plan if it is to include all mathematics. For instance, there is no generally agreeable Stokes theorem in differential geometry. But in any case, the Bourbaki volumes contain a large collection of rigorously proven fundamental mathematical theorems. It is a great asset in mathematical literature.

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Komaravolu Chandrasekharan

André Weil's passing brings back to memory Samuel Johnson's remark on the death of a close friend: "Howmuchsoever I valued him, I now wish I had valued him more." Weil was the first to introduce me (1947) to Georges de Rham's work on differential forms and multiple integrals and to the work of Laurent Schwartz on distributions. He personally introduced me to the glories of Greek sculpture at the Louvre in Paris on my first visit there (May 1949). After his lecture at the Amsterdam Congress (ICM 1954), to which he was fetched by Kloosterman direct from the airport, we spent the afternoon among the treasures of the Rijksmuseum. He was supportive in concrete ways at the turning points of my career, when I moved to Bombay (1949), and when I moved out of there (1965)—always kindly, hospitable, and encouraging. Unforgettable are the days we spent together at Pontresina, in the high Swiss Alps (1967), admiring the snow-clad peaks as well as Hecke's mathematical achievements.

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He left what he wanted his fellow human beings to know about him in his corpus of published work. All his work, however, was governed and unified by his remarkable personality. His French was pellucid. He was endowed with poetic sensibility and metaphysical insight. His creative élan and intellectual power will long be missed. He had that kind of charisma which demanded respect through admiration. When someone characterized him as cantankerous, someone else rejoined that his long and happy marriage showed that he could not be all that cantankerous. Eveline and he were as close as candlewick to candle flame. The distinctive hard shell of his personality was established at an astonishingly early age; he was confident, articulate, and independent. He had a tireless curiosity about the world, which was "so various, so beautiful, so new," in Matthew Arnold's words, and he had the capacity to assimilate ideas, attitudes, and qualities, combined with the sharply defined sense of his own wants. Mathematics and poetry (Greek and Sanskrit) afforded him a way into the sublime; travel lent enchantment to the enterprise.

He was a radical in the true sense who always tried to get to the root of things, though there were strains of traditionalism in him. This was so whether he was considering departmental budgets or diophantine equations, functional analysis on groups or zeta-functions, abelian varieties or the theory of correspondences on an algebraic curve. It has been said that the only success which is man's to command is to bring to his work a mighty heart. This he certainly did with his *Foundations of Algebraic Geometry* (1946), with "the precision of its language and the completeness of its proofs" in Harish-Chandra's words. His famous theorem (1940, 1948) on the Riemann hypothesis for curves over finite fields was built on those foundations and will remain a standing witness to his triumph as a mathematician, a triumph which stemmed from uncompromising self-reliance. "He lighted himself up with the fuel of himself." His radicalist approach to questions of administration did not always endear him to the authorities, some of whom resented his success and found his chirpy personality and dry humour not exactly ingratiating. He never courted popularity but was grateful when it came, as it did with the publication of his book on topological groups, with its dedication to Élie Cartan written in the confines of prison, or his last one on the years of his apprenticeship. He carried an air of quiet satisfaction whenever his audience in a lecture overflowed the auditorium, as it did at the Helsinki Congress (ICM 1978).

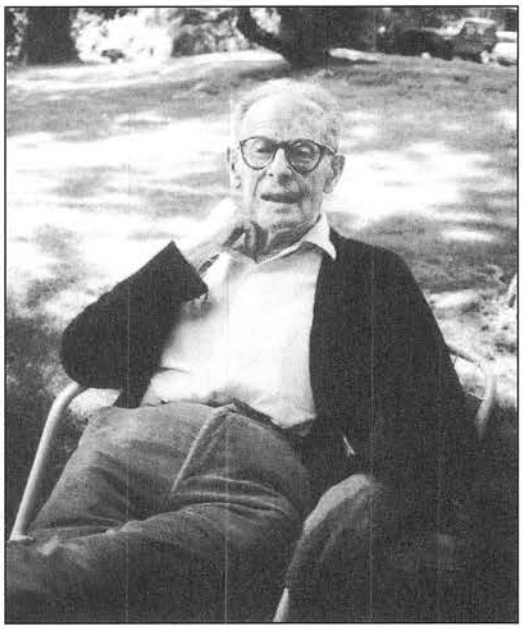
His precocious fascination for epic poetry began with Homer's *Iliad*, in Greek, which in turn quickened his interest in Sanskrit, and led inevitably to the great epic *Mahābhārata*. Its core, the *Bhagavad-Gīta* (the Song of God) stirred his blood as nothing else did either before or since. He acquired sufficient Sanskrit to be able to read the *Gīta* in the original with the help of a Sanskrit-French dictionary and an English translation. He was taken in as much by the beauty of the poem as by the thought that inspired it. The *Gīta* is perhaps the most systematic spiritual statement of the "perennial philosophy", embodying those universal truths to which no one people or age can make exclusive claim. Eminent Indologists like A. K. Coomaraswamy have expressed the opinion that it is "probably the most important single work produced in India." The *Gīta* remained Weil's close companion all his life, through thick and thin, as it did with Gandhi.

Photograph by Lucien Gillet, provided courtesy of Sylvie Weil.

André Weil in the family apartment in Paris, 1952.

Kālidāsa's lyric poem *Meghadūta* (the Cloud-messenger) enraptured him—as it has at least fifty generations of Indians—with its delicacy and grace, its mellifluous diction, its lyrical concision, and its suggestive power. Kālidāsa's deceptively simple Sanskrit is the despair of translators. Weil was struck by Kālidāsa's mastery of the Sanskrit language, of its grammar and rhetoric and dramatic theory, "subjects which Hindu savants have treated with great, if sometimes hair-splitting, ingenuity," in the words of Arthur Ryder (Berkeley, 1912). He came upon the fact that in India, Pāṇini's invention of grammar (ca. fourth century B.C.) had preceded that of the decimal notation and negative numbers. Pāṇini's *Aṣṭādhyāyi* (eight chapters) consists of nearly four thousand aphorisms, the *sūtras*, enumerating the technical terms used in grammar and the rules for their interpretation and application. The Sanskrit term for grammar is *Vyākaraṇa*, which literally means "undoing", implying linguistic analysis. Weil could very well say that "nothing he later came across in the writings of Chomsky and his disciples seemed unfamiliar to him."

Having delved that deep into Sanskrit studies, he was ready to jump at any offer of a chair in India, which eventually turned out to be mathematics (1930–32). It was in Helsinki on the opening day of the Congress (ICM 1978), as we emerged from a reception given by our Finnish hosts, and the evening was spread against the sky, that he suddenly asked me to recite the first line of the first stanza of *Meghadūta*, which he so dearly loved. I had not then known, as I did later, the intensity of the impact of India on his personality. Joseph Brodsky has said: "A



Photograph by Eric Weitzner, courtesy of Sylvie Weil.

Weil at home in Princeton, 1994.

man is what he loves. That is why he loves it; because he is a part of it." His colleagues at Princeton, Gödel and Oppenheimer, were ardent admirers of the *Gīta*. Oppenheimer's citation of lines (often misquoted) from the *Gīta* (Ch. XI, verse 32) as he witnessed the first nuclear explosion has entered the history of American science. Neither of them, however, could visit India as they had wished—the one for health reasons, and the other for political.

It is typical of him and his ways that some of Weil's most serious statements were made in short sentences in the most casual way in private conversation. When he came to see me in Zürich in 1970, he started a conversation by saying, "By the way, you know that I do not accept honorary doctorates." One recalls Marianne Moore's lines: "The deepest feeling always shows itself in silence; not in silence, but restraint." He was known for his short temper and for his sudden, provocative interventions, which sometimes resulted in abrasive confrontations. That was the less enduring side of his personality. It is in his writings that his personality really shows through—as a master of style, with deep reserves of reading, reflection, and self-scrutiny, with a hotline to the creative imagination.

Where he was, there was French culture. But one lapse of judgment on his part, at the outbreak of the war (1939–45), cost him no end of trouble in his mother country. America found him a position worthy of his talents, first in Chicago and then in Princeton, where he made his home. It is Auden, whom he knew, who said that home was a sort of honour, not a building site. Tagore, whom he met in India, used to say: "Blessed be he whose fame does not outreach the truth." Weil was blessed in that sense. I see his spirit floating serene over the rough reaches of time.

Armand Borel

André Weil had a strong sense of humor and a sharp wit. Whenever he perceived a comic aspect in some situation or statement or he strongly disagreed with someone's opinion, this would usually translate into an oral or written comment which could be biting, sometimes even hurting, or simply amusing, with little or no venom. I would like to describe two examples in the latter vein, pertaining to incidents which occurred while he was on the faculty at the Institute for Advanced Study.

The presence of Weil here of course enlivened considerably our faculty debates and meetings, maybe too much sometimes. Once, when we were considering projects for a new library, an extremely acrimonious discussion developed about the future location of the mathematics library. We have had in the course of the years our share of heated debates on various questions, but that one was really about a minor point, absurdly out of proportion with the tone of the discussion. The following day, I told Weil it had reminded me of *Le Lutrin*. The latter is a classic of seventeenth-century French literature, written by N. Boileau, which describes a battle between two factions of monks in a monastery about the location of a lectern (lutrin). It is a poem, written in the style of great epics like the *Iliad*, narrating how those monks heroically fight by hurling big dusty old books at one another. This comparison amused him. As far as I was concerned, that was the end of it, but not for him, because two or three days later our director, R. Oppenheimer, received a letter in seventeenth-century French (see sidebar), signed "Boileau", or, rather more ceremoniously, "of your Magnificence, the very humble and very obedient servant, Nicholas Boileau-Despreaux," addressed to Monsieur Robert Oppenheimer in his School (Eschole) of Princeton in the New Jersey at the Indians of America, saying in part: "In the kingdom of shadows, there is much talk about the debates, so glorious for you, in which you were pitted against some people who wanted to quickly dispatch here the rest of humanity. It is also said that you know modern and ancient languages, including that of the brahmins, so I shall express myself in French, my mother tongue, rather than in yours, which I understand well, but use only with some difficulty.

"You surely know that, once per century, our ruler Pluto grants us a leave during which we are allowed to reincarnate ourselves on the earth...Our queen Proserpina has informed me of the great war which is developing in your Eschole. It is even said that cannons have already thundered."

Boileau adds that as he wishes to come back as a historian, this would be a most appropriate topic of investigation for him, and so he applies for membership with stipend, because once on the earth he will have the same needs as ordinary mortals. He also gives as credentials *Le Lutrin* and his former official title of historian of the King.

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A version of this segment in French is appearing in the Gazette des Mathématiciens.

For the enjoyment of readers familiar with French, here is the original.

A MONSIEUR Monsieur Robert Oppenheimer En son Eschole de Princeton dans le Nouveau Jersey ches les Indiens d'Amérique

Je ne sçais, MONSIEUR, si ce peu de réputation que j'eus de mon vivant sera parvenu jusqu'à vous. Mais je puis bien vous dire qu'ici, au royaume des ombres, il n'est bruit que de vous et des débats, si glorieux pour vous, où vous fustes opposé à quelques savantastres dont le charitable dessein était d'expédier promptement chez nous tout ce qui reste d'hommes sur la terre. On dit aussi que vous sçavez parfaitement les langues tant anciennes que modernes, et mesme celle des brachmanes. C'est ce qui fait que pour vous escrire je m'exprime en françois, ma langue maternelle, plutost qu'en la vostre que j'entends fort bien, depuis que Messieurs Pope et Addison m'en communiquèrent l'usage, mais dont je ne me sers qu'avec un peu de peine.

Vous n'ignorez pas, MONSIEUR, qu'une fois par siècle notre auguste souverain Pluton nous accorde un congé durant lequel nous avons permission de nous réincarner sur terre. J'ay dès longtemps songé à consacrer à Calliope mon prochain séjour parmi les vivans, car j'eus autre fois pour l'histoire un goust fort prononcé. Mesme j'eus l'honneur d'estre historiographe du roy. J'advoue que je n'ay rien laissé qui m'acquitast envers la postérité de ce qu'elle eust eu droit d'attendre de moi à ce titre. Du moins osay-je me flatter que mon poème du LUTRIN aura asseuré à mon nom quelque durable renommée parmi les sçavans férus d'histoire ecclésiastique, et que votre docte confrère, M. le Conseiller Aulique Cantorovitche, si versé en celle-ci, ne manquera pas d'en témoigner.

Or notre auguste souveraine Proserpine, constamment informée par les voies les plus sûres de ce qui se passe au monde des vivans, a daigné me faire avertir de la grande guerre qui pointe en votre Eschole, sur le sujet de votre librairie ou bibliothèque. Mesme on dit que le canon aurait desjà tonné en vos murs, et que vos mathématiciens s'apprestent à la deffense. Je ne sçaurois certes trouver plus digne sujet pour ma Muse.

Mais, lorsque nous autres morts rendons visite aux vivans, nous devenons sujets, tout comme vous, à de fascheuses nécessités, c'est de manger et de boire. Des gens dignes de foi m'ont asseuré qu'il est en votre pouvoir, après avoir pris avis de vos conseillers ordinaires, d'accorder des pensions ou stipendia à ceux que vous en jugez dignes. Aussi osay-je m'adresser à vous, avec l'asseurance que ma requeste, dont l'effet sera d'immortaliser votre Eschole, ne peut manquer d'estre receue de vous avec faveur. C'est dans cette persuasion, MONSIEUR, que j'ay l'honneur de me dire ici

—De votre Magnificence
Le très-humble et très-obéissant serviteur
Nicholas BOILEAU-DESPREAUX"

Shortly after, Weil sent a short note to E. Kantorowicz, the executive officer of the School of Historical Studies:

> I hear that Dr. Oppenheimer has received an application for a stipend from my famous countryman, Monsieur N. Boileau. Obviously this concerns your school. May I nevertheless, without impropriety, put in a word of recommendation? His project seems most promising. It is true that he has been dead for a great many years. But surely, in the eyes of historians and scholars, this should be counted as a feather in his cap.

(A faint allusion to the fact that the average age of visitors in historical studies was much higher than in mathematics, an impression which Weil made more precise during his first year here, 1958–59, by drawing a graph of the age distribution of temporary members in the various schools. For mathematics it started at 21, had a high peak at 30–34, then decreased to at most one between 45–49 and 60–64. In historical studies it began at 27–29 with one member, had two peaks at 50–54 and 65–69, and showed still one member in the range 80–84.)

Some days later, Oppenheimer offered a 25-year fellowship to Boileau. Needless to say, the library discussions were hardly the same later on.

In July 1969, D. Montgomery felt unusually hot in his office at one end of the ground floor of Fuld Hall. Of course, there is nothing unusual about hot and humid weather in Princeton at that time of the year, but that was really out of the ordinary, so much so that Deane went down to the basement to see whether he could find a cause for it. To his great astonishment, he saw that a room was being permanently heated, serving as a breeding farm for pheasants and other high-class fowl. He wrote a short note to the general manager, asking that this be removed, which was done, but not before the news had spread all over. Deane, who was at the time executive officer of the School of Mathematics, soon received the following letter from Weil:

> It is my understanding that Fuld Hall is being converted into a Pheasant Breeding Farm, and that, for what must appear to everyone as narrowly selfish motives, you have raised objections against this excellent plan.
>
> Had you canvassed your colleagues first (as was your obvious duty), you would have discovered that there is widespread and enthusiastic agreement in favor of the aforesaid project—it being understood, of course, that a bonus of

Photograph courtesy of Sylvie Weil.

André and Eveline Weil in Princeton, about 1985.

> a brace or two of those valuable birds would be distributed at Christmas, Thanksgiving and other suitable occasions, to all members of our Faculty...I should be obliged if you would formally communicate these views of mine to all those who are in any way concerned with or interested in the Pheasant Project (first and foremost, of course, our Director).

Weil's irony was sometimes a way to let off steam in tense situations. Weil was indeed temperamental, could not stand cant or humbug, and was extremely serious, even intense, about matters of interest to him, which he pursued thoroughly. As anyone can gather from his autobiography *The Apprenticeship of a Mathematician* (Birkhäuser, 1992), his cultural and linguistic interests were broad and deep. Besides being fluent in several modern languages, he enjoyed reading in the original Latin (his daughter Sylvie told me once that, while preparing for the French "Baccalauréat", she would sometimes ask him for words encountered in Latin texts but not included in her dictionary, presumably on grounds of decency) or Greek or the *Bhagavad Gīta* in Sanskrit. Still, however substantial those were, mathematics had by far top priority. Obviously, he viewed it as his main mission to contribute to its progress, and his life was organized to a large extent with that goal in mind. As he told me once, thinking of his other interests, this indeed entailed shutting quite a number of doors. In personal mathematical contacts, he was a driving force, always ready or eager to discuss, explore, push further, inform, and be informed. In 1955 I was in Chicago, living with my wife and our first daughter in the same house as the Weils. Early one morning I had a mathematical idea which, though very simple, was so crucial for my work that I could not wait to check with him whether it was sound. I called, explaining why I wanted to see him. His wife, Eveline, who had answered, told me he was preparing to leave for a short trip out of town. So I said, slightly disappointed, I shall wait until he comes back. "Oh no," she replied after having talked with him, "for André, mathematics always comes first; he will find time to see you before leaving." The Weil family was living in an apartment on the ground floor. The room he had chosen for his office was sticking out, with windows all around, and he could be seen working there seemingly constantly, mostly typing, as if glued to his typewriter. Once the janitor told him, "You are working so hard. If you go on like that, you will become very famous." As Mark Twain has pointed out, it is always hazardous to predict, especially the future. Here she was in fact predicting the past as well as the future, so she was on safe grounds.

Pierre Cartier

In 1957 the University of Chicago accorded a sabbatical leave to André Weil, who spent it in Paris. In fall 1958 Weil was named a permanent professor at the Institute for Advanced Study (IAS).

He adapted immediately the Séminaire Hadamard of his youth into a "Joint Institute-University Seminar on Current Literature", which lasted from 1958 to 1962. Nearly every year he gave a course at the IAS. There were successively three great areas of interest, all linked to number theory:

a) adeles and algebraic groups; application to discrete subgroups of Lie groups;

b) automorphic functions and Dirichlet series;

c) history of number theory.

Weil was not what one would call a great speaker; I speak from experience, having taken at Princeton his courses in spring 1959, fall 1965 and 1969, and winter 1973–74. His written mathematical style was often heavy, not approaching the sarcastic elegance of his *Souvenirs.*[1] One learned much in taking his courses, but it was necessary to be intrepid, and this always limited the number of his students. He developed at length interminable calculations and took a cunning pleasure

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This segment is an authorized translation of an extract of the author's article "Andre Weil (1906–1998: Adieu à un ami" planned for a Web page at http://www.ihes.fr/.

A longer extract of this article is appearing in French in the Gazette des Mathématiciens.

[1]Souvenirs d'Apprentissage, *Birkhäuser, Basel, 1991; English translation by Jennifer Gage,* The Apprenticeship of a Mathematician, *Birkhäuser, Basel, 1992.*

in giving the point only at the very end. I remember in particular the last class in fall 1965, two days before Christmas. The audience was essentially European; each of us was carrying an airline ticket for the flight home, and we had left our luggage in the entry. He waited until the final minutes to formulate what would become the Taniyama-Shimura-Weil conjecture.

During all this period he had even fewer students formally than in Strasbourg or Chicago—only perhaps Demazure and Ono in 1960. Nevertheless, many of us would scrutinize each of his articles to find help or inspiration; number theory owes him an enormous debt, to the point of putting in place an important part of the strategy that was going to allow Wiles to solve the Fermat conjecture in 1994.

Viewed from the outside, his life in Princeton hardly differed from that of distant gods like Gödel or Einstein. He led a comfortable but austere life, modeled on that of the English colleges. After long sessions of work in his office in the basement of his house, surrounded by his wonderful library, came a ritual visit to the Institute a little before lunch. I had the immense good luck to share long walks with him in the Institute woods, or sometimes along the frozen Lake Carnegie in winter; we discussed his published articles or ones in progress, or we discussed the plans for Bourbaki. He had rather little social life, aside from concerts on the campus or in town and some parties at colleagues' homes. Few of us entered his house, in Princeton or in Paris, and caught sight of the retreat where he did his thinking.

André Weil never had the reputation of being an easy personality; his mockeries were formidable and fearsome. I remember several stories at the time of his settling in Princeton in 1958. Leray spent the fall at the IAS, and I listened to his course on the theory of residues for functions of several complex variables; as usual, this course was profound and obscure. Weil arrived some weeks late, and my wife and I had already firmly established a friendship with Leray, who was alone and happy to find a welcome. One day when all three of us were together, Weil found himself face to face with Leray, neither giving way. I knew that there were old feelings of hostility between Leray and Weil, and I tried to save the situation in comic fashion by introducing one to the other. I received several hours later two confessions in nearly identical terms: "...si vous le connaissiez depuis aussi longtemps que moi, vous comprendriez que son venin est désormais plus sucré... ."[2]

Some weeks later, Grothendieck spent several days in Princeton. Borel organized in his office an unpublicized seminar that lasted one Saturday from nine in the morning to six in the evening, with a short break for lunch. Grothendieck lectured on the same subject as Leray, with more generality, but, in contrast with the analyst Leray, he adopted a resolutely algebraic point of view. At the end of this long session, Weil commented in a loud voice, "We ought to ask our colleagues in physics to invent a principle of anti-interference, which would have light burst forth from two darknesses (Leray and Grothendieck)."

Weil retired in 1976. He remained in Princeton, since his family had settled in the northeastern part of the United States. It was his custom right up until his death to spend spring in Paris and summer in the Mayenne. He still wrote some articles, mainly about the history of mathematics, but his main achievement is composed of two books: the first[3] is a rereading of Eisenstein, which opened up new directions in algebraic number theory. The second[4] sprang from his last courses, in which he had had the ambition of going from Fermat to the present time. He explained there all he learned by reading Fermat and Euler. For him the history of mathematics signified above all rereading the classics for inspiration. At the same time, he edited his *Œuvres Scientifiques* in three volumes and added to each volume an extremely rich "commentary", which is in fact an intellectual autobiography.

Photograph courtesy of Sylvie Weil.

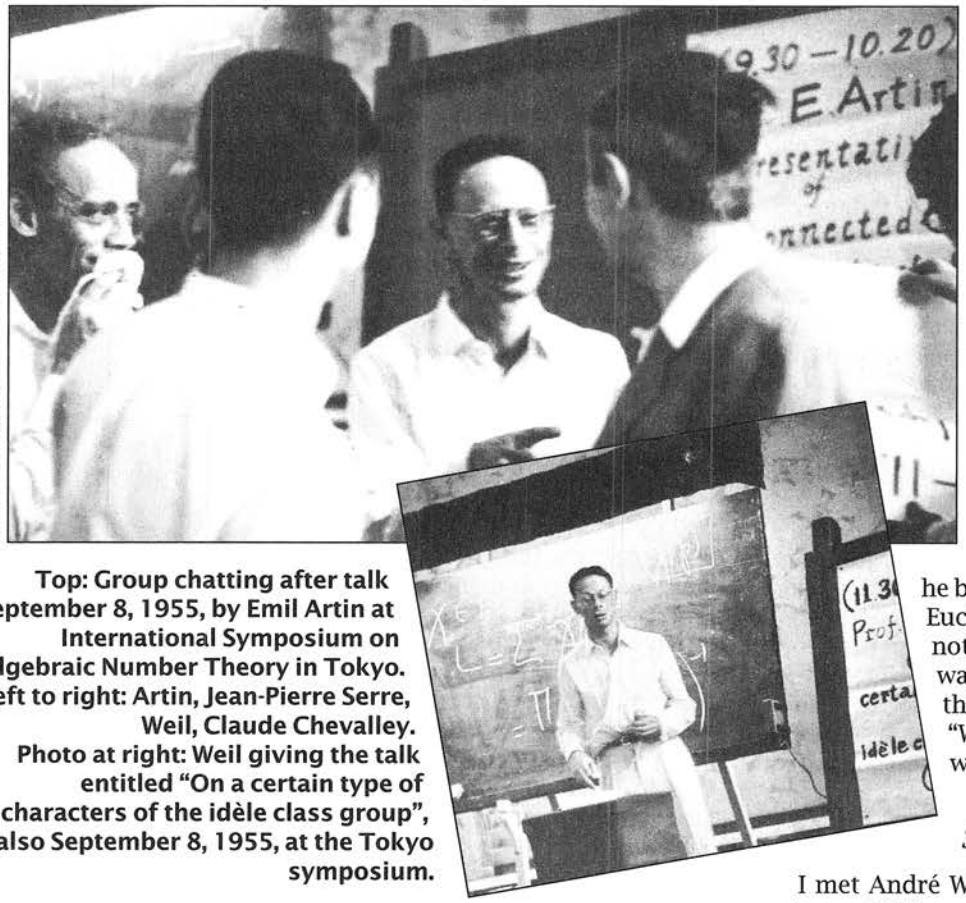
Weil and his daughters, Sylvie (left) and Nicolette, in Princeton, January 1966.

His wife, Eveline, died in 1986, a few days after André's eightieth birthday, definitely breaking his momentum. With his remaining strength he wrote his *Souvenirs*, as a last tribute to his wife and his sister. He kept to his old habits, but his lack of domestic sense and his poor eyesight left him a prisoner of various domestic helpers in Princeton and in Paris. Each time that I saw him in Paris, he was a bit lost in the large apartment of his parents, from where one dominated the Jardin du Luxemburg and from where one could view Paris as far as the Sacré Coeur. This apartment became his after the death of his mother, with whom he had protracted fights. It was also a Paris home for his older daughter, Sylvie, who has successfully combined the cultures of New York and Paris—Woody Allen and Sartre. After Eveline's death we customarily took

[2] *"If you had known him as long as I have, you would understand that his venom has become sweeter."*

[3] Elliptic Functions according to Eisenstein and Kronecker, *Springer-Verlag, Berlin, 1976.*

[4] Number Theory: An Approach through History from Hammurapi to Legendre, *Birkhäuser, 1984.*



Photographs by Asako Hatori, provided courtesy of Shokichi Iyanaga with permission of photographer.

Top: Group chatting after talk September 8, 1955, by Emil Artin at International Symposium on Algebraic Number Theory in Tokyo. Left to right: Artin, Jean-Pierre Serre, Weil, Claude Chevalley. Photo at right: Weil giving the talk entitled "On a certain type of characters of the idèle class group", also September 8, 1955, at the Tokyo symposium.

some meals each year in some restaurant in the Latin Quarter. I also sometimes took him for a day's visit to my home, in the woodlands of the Beauce, near enough to Chartres for a detour to visit there on the way. He was happy to be able to take a long walk in the beautiful woods and princely parks of my little region.

I remember clearly three of his later visits to Paris. First, there was the summer when unfortunately he broke his leg on one of those anti-car barriers that the Paris administration has put on many sidewalks (he was always nearsighted and paid the price for his myopia); Cartan, his elder by two years but still quite lively, had to struggle to get him to the hospital.

Next, after the publication of his *Souvenirs* he spent a long evening with me near Odéon, defending his story of his imprisonment in Helsinki in fall 1939, which was refuted by the Finnish police archives exhumed by a young colleague in Helsinki.

Finally, in 1994 he had just learned he would receive the grand Kyoto Prize for his work. He cared to go in person to the ceremony; Sylvie, like a modern Antigone, dressed completely in black, kept him company in Paris and agreed to share the long trip from Paris to Kyoto via Princeton with him. She was fearful of that journey, and rightly so. It was at this point that I perceived how much he had suffered from being exiled from Paris, even in the gold cage that is Princeton; the fact that his three grandchildren spoke little French and were unaware of all our culture and that his younger daughter had become so American weighed on him a great deal.

During his last two years he sensed himself weak and isolated. The ordeal of the end was relatively light for him; he died suddenly. He had no hope for eternal life, but took comfort that his work would survive him. While founding Bourbaki to promote the unity of mathematics, he believed that it would become the Euclid of the twentieth century; it is not very reassuring that Bourbaki was almost dead before the end of the century. As Valéry prophesied: "We others, civilizations, know that we are mortal."

Shokichi Iyanaga

I met André Weil for the first time in Paris in autumn 1932, soon after his return from India. I came there from Hamburg, where I had stayed for two semesters. After having studied in Tokyo with Takagi, I left Japan in 1931 to study further in Europe, first in Hamburg with Artin, where I was very fortunate to make the acquaintance of Claude Chevalley, who happened to be there just for the same period. At that time only a few French mathematicians were concerned with arithmetic; there were practically none, I believe, apart from Weil, Herbrand, and Chevalley, among whom Herbrand suffered a tragic death in an accident in the Alps in summer 1931, after which Weil and Chevalley were, so to speak, the only French arithmeticians. Weil had published his famous thesis on the arithmetic on algebraic curves in 1928, and I had heard much of him from Chevalley. Thus I had a respect for his work. I did not think that Weil had heard anything of me before our encounter, but he had perhaps some friendly feeling for me, as I was introduced to him by Chevalley. Once we sat side by side at a session of Hadamard's Seminar in the Collège de France. He handed me a little piece of paper with the words: "Écrivez en japonais 'A bas l'armée!'" (Write in Japanese "Down with the army!"). I knew that he was versed in many foreign

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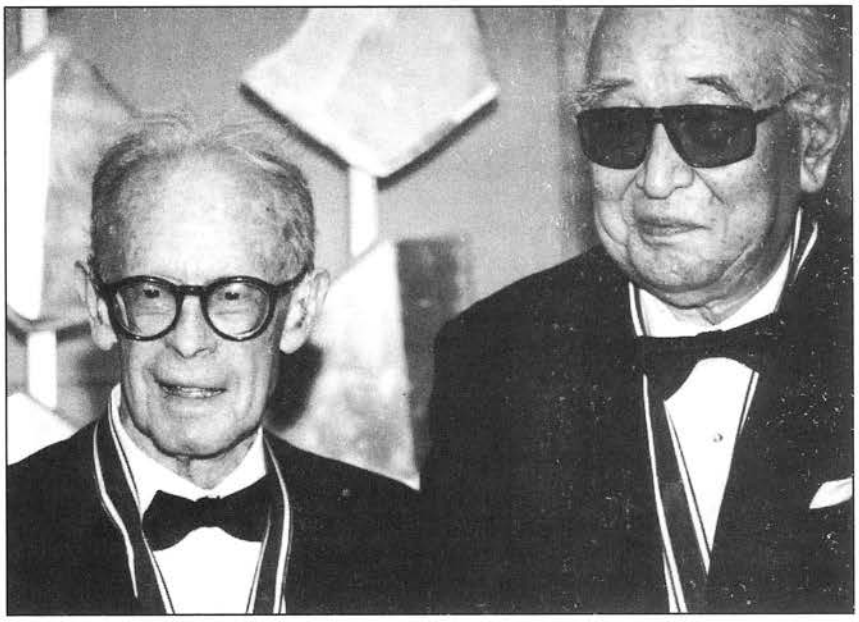
languages, including Sanskrit, but I did not believe that he knew Japanese. I thought, however, that he wanted to see how I wrote these words as a citizen of the country whose army was making insidious maneuvers in China. Thus I wrote with a smile three Chinese characters meaning "Down with the army!" on the same piece of paper and returned it to Weil, which he received with a smile. I returned to Japan in 1934 and was nominated to a post on the teaching staff at the Tokyo University in 1935, but the general tendency of my country (and also of the whole world) went toward the war, to my great disappointment. It was only in 1950, five years after the end of the war, at the ICM in the U.S., that I could see again the mathematicians with whom I had enjoyed friendship in Europe before the war, and five more years later, in 1955, that we could organize the first international symposium on algebraic number theory in Japan, to which we could invite Artin, Chevalley, and Weil, among others.



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Weil with film director Akira Kurosawa on the occasion of the ceremony for the awarding of Kyoto Prizes to each of them, Kyoto, 1994.

Weil came then to Japan from the U.S. by a Japanese ship, some weeks before the symposium. I went to meet him at Yokohama Port one afternoon and invited him to dinner in my family's home that evening. During our conversation, he was anxious to know about what we had been preparing for the symposium. I told him in particular of the works of Taniyama and Shimura on the theory of complex multiplication. He wanted to see them as soon as possible. Therefore I asked them by phone if they could come to my office at the Tokyo University the next afternoon to meet Weil, and I felt how surprised and delighted they were. The following day, Weil was apparently impressed at hearing their talk, but at the same time he found out their weak points; in particular, Taniyama had used van der Waerden's theory of moduli, which had to be corrected in introducing the concept of polarized varieties, as Weil had just intended to speak at the symposium. Arrangements were made among them during the following days about the plans of their talks at the symposium. Weil had already made personal acquaintance with a number of Japanese mathematicians like Nakayama, Kodaira, Iwasawa, and Igusa in the U.S., but it was in this way that his deep influence began to penetrate into the younger generation of Japanese mathematicians. In his comments on his papers contributed to our symposium (in Vol. 2 of his *Collected Papers*) he describes how he enjoyed this symposium. As is well known, Shimura was invited to Princeton, where he still continues his activities up to this day. Taniyama was also invited to Princeton, but very unfortunately he committed suicide before accepting this invitation. We find Weil's very friendly letter to commemorate Taniyama reproduced in Vol. 2 of his *Collected Papers*. (It is also well known that from their conversation during Weil's stay in Japan on this occasion there originated a conjecture on modular elliptic curves which played an important role in the genesis of the proof of Fermat's last theorem by Andrew Wiles.)

I shall now conclude this article by recounting our last encounter in 1994. He came to Japan with his daughter Sylvie in autumn that year to receive a Kyoto Prize. (He was eighty-eight years of age, just like me.) He spent the last several days in Tokyo before leaving for New York. For the last evening, he invited me, together with Mr. and Mrs. Satake, who took care of hotel arrangements, etc., for them in Tokyo, to dinner at his hotel. After dinner we accompanied him to the door of his room. We wished him a good trip to his home and expressed our hope of having another occasion to invite him to Japan. Weil thanked us for all that we had done and said, "the next time perhaps in another world ...", to which we could not find any appropriate words to respond. I parted from the Satakes at the door of the hotel and was left alone. Sitting in a subway train on my way home, I was suddenly taken by an overwhelming sorrow.