From all the principal summits you perceive the vast glacier-clad interior of the country, stretching from north to south in an unbroken line, with a crest as straight as a sea-horizon. As I have already said, there are no marks upon it which enable one to calculate the altitude to which it rises, or the distance to which it extends. But having now seen it from several elevated and widely separated positions, as I find that its summit line always appears lofty, even from the highest mountains which I have ascended, my impression is that its height is generally not less than 8,000 feet, and in some places perhaps surpasses 10,000 feet. Whatever its altitude, it is the only great region on the surface of the earth that is known to be enjoying a glacial period, such as has been supposed, with a high degree of probability, to have existed at former ages over a large portion of the world. Whether it actually extends unbroken over twenty degrees of latitude, and in some parts over more than as many degrees of longitude, or whether it is divided by great fiords into numerous islands, and contains vast lakes in its interior, are questions which no one can answer at the present moment, and are some of the questions which I hope to be able to answer at a future period.

MOUNTAINEERING IN THE GREAT ATLAS. By JOHN BALL, F.R.S. Read before the Alpine Club, March 4th, 1873.

IN the spring of 1871 Sir John Drummond Hay, the British Minister in Morocco, obtained from the Emperor for Dr. Hooker, the eminent director of the Royal Gardens at Kew, permission to collect plants in the range of the Great Atlas. It is well known that, owing to the fanaticism of the inhabitants and the jealous policy of the rulers of Morocco, that great mountain range has been hitherto inaccessible to travellers. About the beginning of this century Mr. Jackson had been allowed to accompany a body of troops despatched by the then reigning Sultan from Morocco to Tarudant, and on the way crossed one of the lower passes in the main chain; but in his excellent work on Morocco that traveller has given no particulars as to a route which has probably never been traversed by Europeans, excepting in the capacity of slaves taken from ships wrecked on the West Coast. Gerhard Rohlfs had in our own time succeeded in travelling in disguise through the eastern part of the Great Atlas, but under conditions which allowed him to give little information as to the country; and

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still more recently M. Balansa, a botanist, had reached the skirts of the mountain range near to the city of Morocco. His excursion was a short one, and he was speedily forced to return to the port of Mogador, and to quit that part of the Empire.

Along with Mr. Maw, a gentleman who has been eminently successful in the cultivation of new and rare plants, I was fortunate enough to be able to accompany my friend Dr. Hooker, and to take advantage of an opportunity unique in the history of Morocco for exploring a region which has long excited in the highest degree the curiosity of naturalists.

Although the time at our disposal was unavoidably limited we were led to hope that the express orders of the Sultan, and the favourable disposition evinced by the Governor of the district nearest to the city of Morocco, would secure to us the necessary facilities for visiting several of the main valleys, and attaining the highest summits of that part of the chain. There is indeed reason to suppose that these may be surpassed in elevation by the more eastern portion of the Great Atlas, inhabited by independent tribes, and virtually independent of the Sultan's authority; but there remained ample occupation of the most interesting kind for the three short weeks which we were able to give to that portion of our journey.

We speedily became aware that even the authority of an absolute ruler does not avail to undo the effects of immemorial tradition, sustained by the influence of religious fanaticism. Although a ride of five or six hours suffices to carry one from Morocco to the foot of the mountains, we found after as many days that we were unable to penetrate into any one of the interior valleys, and that we were constantly baffled by more or less ingenious devices, renewed not once but many times in the course of each day.

After sufficient experience of this vexatious sort of life, our tempers were getting worked up to that point at which further evasion was no longer possible. In the evening *palaver* of the 11th of May, which as usual was held in the tent with closed doors, our Jew interpreter was ordered to explain clearly to the two captains who commanded our escort that we had the Sultan's order to permit us to go as high as we pleased on the mountains, and that if we were to meet further opposition we should send a courier to the viceroy at Morocco, and wait where we were until we received his answer.

As usual, our captains retired to lay their heads together, and finally returned with the Sheik of the next valley, de-

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claring that he was ready and willing to conduct us 'as far as the snow.'

The next day was spent in traversing the low line of hills that divided us from the valley of Aït Mesan, and ascending it to a point at least ten miles nearer to the main range than any we had yet reached. The bolder scenery, Pyrenean rather than Alpine in character, the sight of a real mountain torrent with a tinge that spoke of melting snow, and the seemingly friendly disposition of the sheik, all put us into better spirits; and our good humour was increased by an abundant harvest of plants, some rare, others quite new to science.

Without any overt opposition, the arrangements were made for a start on the following morning.

We were distinctly assured by our Sheik that he was to lead us to the snow; and as the only snow visible lay on the upper zone of the highest mountains, the promise seemed to mean a good deal. But on the other hand it appeared to me that our position with reference to the head of the valley was something like that of Châtillon in the Val Tournanche, and that, doing our best, we could not expect to attain to any great height on the lofty rugged barrier that shut us in on the south, if we were, as arranged, to go and return on the same day.

As we left our camp standing and our escort in charge of our possessions there, little delay should have occurred next morning; nevertheless the start was not made till about six o'clock. The scenery was very interesting; the plants so attractive that the utmost strength of resolution was needed to content ourselves with merely grabbing hastily at such specimens as were beside the path; but the feeling that we were on the threshold of *terra incognita* carried us forward, and little time was wasted by the way. The track was not very bad until, after more than three hours' steady progress along steep rough mountain slopes, first above the left, then above the right bank of the valley, we found ourselves riding along nearly level ground only a few feet above the level of the torrent. But this did not extend far. In front a steep convex declivity seemed to separate us from the proper head of the valley, and on the left hand a minor glen opened nearly at the same level. Midway on the declivity in front of us was perched a small village. Above this the rocky ground rose, rugged and patched here and there with shrubs and small trees, but below the land was cultivated and enclosed by stiff thorny fences and walls of loose stones. We had passed from summer into spring, and had left the last olive-trees below us, so the corn was not yet in ear.

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I had occasion to become well acquainted with the path leading up to that village, and I shall never forget it; for though there is no obvious reason why it should be more detestable than any I ever encountered elsewhere, it undoubtedly seemed so the first time I passed it; and it appeared considerably worse on each successive occasion when I repeated the passage. It winds up between the aforesaid stone walls topped by spiny shrubs, and at the same time serves as the bed of the stream that flows out of the lateral glen. Eager to snatch such plants as came within my reach, I had dismounted, and made my way on foot ahead of my companions who sat sedately on their mules. As we advanced the way grew rougher, the stones were horribly slippery, with holes between big enough to hold a man's leg up to the knee. The wonderful Morocco mules scrambled up behind me, but not without desperate struggles; and when I would fain stop to gather a lovely pale blue daisy from the crevices on either hand, I was forced to scramble on through the plashing stream on pain of being jammed against the wall. It was a slight consolation to me to discover afterwards that my companions had not so much the best of it as then appeared. All sorts of thorny bushes with straight thorns and curved spines and hooked prickles, and amongst them the gooseberry-bush—dear to our childhood's years—hang their branches above the track; and the horseman who passes that way must keep a very sharp look-out if he does not wish to try the effect of each and every one of them on the cuticle of his face.

We reached the village; and although we were on this day without our interpreter, it was made clear to us that we were expected to halt and accept an entertainment that had been provided in anticipation of our arrival. I suspect that some of us were not sorry to get a little nourishment, though all were anxious to push on; but it was clearly impossible, without offending the feelings of the natives, to refuse their hospitality, and we put the best face we could on the matter, although the delay cost us more than an hour of precious time.

About eleven o'clock we made a fresh start along a fairly well-constructed path that winds up the rocky slope, and in little more than half-an-hour we reached the summit, and presently found ourselves at Arround, the last and highest village in the valley. A wilder spot cannot easily be imagined. We had reached a height of about 6,500 feet above the sea, and on every side rugged masses of dark red rock rose to about an equal height above the floor of the valley. This extended nearly at a level for about three miles ahead of us, and then

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the mountains seemed to close together. The highest peaks of all were concealed by heavy clouds, and between them fell steep ravines, whose slender streamlets joined to form the torrent that meandered through the level ground near at hand.

We now perceived that, although little snow had been visible from a distance, there was no lack of it, and that, too, at no great distance. Numerous considerable patches remained unmelted in sheltered spots, descending to within some 1,500 feet of the level of the village, and it soon became clear that our Sheik intended to fulfil his promise by leading us to the one which seemed easiest of access.

I need not now detail the remainder of our day's work, which became exciting enough before we got safely back to the shelter of our tents, some time near midnight. The obvious result of the expedition was to whet, but certainly not to satisfy, our mountaineering appetite. It was plainly impossible that, having seen our way to reach the crest of the Great Atlas, if not one of its higher peaks, we should allow ourselves to be drawn aside, and to forego the main object of our journey when it was actually within our grasp.

Many difficulties remained, however, to be overcome, and the worst of these were on the side of our escort. It was not merely that they were full of vague suspicion as to the real object of our journey; they had a still more direct motive for longing to quit the valley of Aït Mesan. The place was poor; and, although in pursuance of the Sultan's orders, they were amply supplied with the necessaries of life, they could not here feast on the fat of the land, as they had done in the richer districts at the foot of the mountains, for the simple reason that the land here offered no fat on which to feast. The only way to checkmate the escort was to secure the active co-operation in our plans of the friendly Sheik. He undoubtedly bore us no love; but, unlike most persons of his class that we encountered in Morocco, he appeared to have no fixed aversion to the Giaour, and well enough disposed to get whatever he could for himself out of the strange visitors.

To convert this natural feeling into decided partizanship, we resorted to the chief engine of seduction that had been provided for such a contingency. Shortly before leaving London I saw one day in an old curiosity-shop a quaint weapon of the form of an old horse-pistol, but provided with four barrels of goodly size, each capable of discharging a half-ounce bullet, the whole framed to go off at the same time. We had ascertained that the other articles we had provided as presents—watches, musical-boxes, opera-glasses, and the like—excited

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but moderate desire in the Moorish breast; weapons alone seemed to be really prized; and of all weapons this four-barrelled machine, which we called the Young Mitrailleuse, promised to be the most formidable. The gift was presented in due form, and the Sheik was secured. I feel quite sure that whenever the Young Mitrailleuse is called into action the result will be deadly, but not at all persuaded that the victim will be the man against whom it is directed.

Our plan was to return next day to Arround, and on the morrow obtain a long day for ascending as high on the main range of the Atlas as circumstances should permit. Many small questions arose that excited vehement controversy. Certain large tin cases, intended to be packed with living plants, were the main cause of dispute. Finally, the Sheik absolutely refused to allow them to proceed. Nothing, he said, could persuade his people that they were not filled with treasure; they would surely attack us in the night, and murder us all, in order to gain possession of them. The boxes were left behind, and we once more started next day for the head of the valley, bidding a short farewell to our escort, who remained to guard the camp with the vegetable treasure we had already secured—quite as valuable in our eyes as though our boxes had really been laden with the precious metals that the natives imagined.

All went smoothly enough that day. When we reached Arround we found ready for us a native house, whose occupants had been turned out to make room for the strangers. Two very small dark rooms on the ground floor; two more, nearly equally dark, above them; and an open verandah, adjoining the last, made up the Schleuh dwelling-house. Preferring fresh air, Dr. Hooker and I chose the verandah; Mr. Maw selected one of the adjoining rooms; the other served as our kitchen. A stroll up a lateral glen to the east, and the treatment of a number of natives who came to implore medical advice, occupied the afternoon. At dark we applied ourselves to the evening meal, which was enlivened by one of the precious bottles of wine, carried safely from England, with which Mr. Maw had enriched our stores. After this the natural proceeding would have been to lie down to sleep; but, according to our usual practice, Dr. Hooker and I struggled on through a good part of the night in the effort to sort and lay out our plants by the flickering light of a candle, which we vainly strove to shelter from the wind. Having liberally sprinkled the floor with insect powder, we at last lay down to welcome sleep.

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The night was very cold, and when we rose at daybreak on the 15th of May, the sky was dark, and heavy clouds roofed the valley across. After a little delay for breakfast, we started full of anticipations of the coming day. The floor of the valley stretches nearly level for some distance, at a height of nearly 7,000 feet above the sea. Near the village small fields divided by low stone walls, and some tolerably well-grown walnut-trees, were the only sign of man's appearance on the scene. Above and beyond all looked rugged and bare. On the lower slopes a covering of stunted, sombre-looking shrubby plants; above, dark red and brown rocks. Dotted about on the mountain sides were solitary trees of dark hue and conical form, which at once excited our curiosity. We afterwards found that they belong to a species of juniper common enough on the northern shores of the Mediterranean, where it is a mere bush with a stem as thick as a stout walking-stick. In the Atlas it attains to the dimensions of a forest tree, five or six feet in girth, and flourishes at a level of nearly 10,000 feet above the sea.

Anxious as we were to get on, it was simply impossible for a party of naturalists to travel fast over ground where every dozen paces brought us face to face with plants altogether new to us, and many of them hitherto unknown to botanists. Nor were we much less interested to meet in such an unexpected quarter with many of the common plants of central and northern Europe, at a distance of many hundred miles from their nearest known stations.

Luckily for us, as it turned out, the Sheik had no taste for mountaineering on his own account. He had appointed two active fellows professedly to show the way, and we had besides two of our own faithful attendants, who had accompanied us throughout the journey from Mogador.

One of these was of especial service. He had already picked up eight or ten words of English from the seamen in the port of Mogador, and had gradually added to his vocabulary during the journey. Being a Schleuh by birth, he spoke the language of the mountains as well as the Moorish Arabic of the plain, and was able, to a limited extent, to serve as interpreter. Added to this, his general intelligence, activity, and good humour, made him an invaluable attendant. In about three hours we had reached what might fairly be called the head of the valley, at a point where several streams descending from as many ravines join to form the main torrent. Here stood a small stone shed, and here commences the actual ascent to the Tagherot pass, leading to Sous and the Sahara.

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It was now made clear to us that this was intended to be the limit of our excursion. Between a few uncouth scraps of English and abundant gesticulation, it was explained that the people of the opposite slope were given to the practice of shooting at strangers, and that we should risk our lives if we attempted to go any farther towards the pass. It did not suit us to attempt controversy; we appeared to be satisfied, and to be busily engaged in searching for plants in the neighbourhood of the shed. At this time the rain most opportunely began to fall, and as the air was extremely cold and raw, we suggested the propriety of lighting a fire in the shed. This quite suited the fancy of our scantily-draped attendants, and ten minutes after they were crouching over a fire which they had contrived, I know not how, to light. With one accord, we immediately started along the beaten track which, as we already knew, led up to the pass. As we pushed along up the tolerably steep slope, keeping always within sight of the path, but drawn to one side or the other by the new plants that came into view, the weather grew steadily worse, and we rightly calculated that our friends below would not suspect us of stealing a march on them, and that even if they were to look out for us we should very soon be lost to view.

An unexpected incident interfered with our project, and might well have marred it altogether. When we had ascended some 700 or 800 feet, and were already out of sight of the shed, we caught a glimpse of moving forms on the track above us, dimly visible through the rain now mixed with sleet. It presently became evident that a party of natives, with two or three mules, were descending along the zig-zag track. It was a strange position for three Englishman, not knowing a single word of the language, in a part of the world where the natives are utterly unused to see a stranger even from the neighbouring low country. We had no idea of attempting to conceal our presence; but we thought it judicious not to give them time to meditate hostile designs, and therefore kept some rocks between us and them until they were quite near at hand, and then allowed them suddenly to see us when only some twenty yards distant. What they may have thought we had no means of telling; they passed on, and we continued our ascent amid weather constantly growing worse. As it became pretty clear that the ground would soon be covered with snow, our feverish anxiety to procure specimens of every flowering plant that we met grew stronger every moment, and was only combated by the desire to reach at least the summit of the pass.

In less than an hour after our encounter with the native

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party we began to hear shouts and screams from below. We rightly guessed that the strangers had reported the circumstances, and that our guides were hastening after us to induce us to turn back. This was, of course, an excellent reason to urge us to push on; but our pursuers were light of foot, and by the time we had attained a height of about 11,000 feet the first of them overtook us. Mr. Maw, the youngest of our party, was a little ahead, and to him the most vehement remonstrances and gesticulations were addressed. Mr. Maw used the argument which is understood in almost every known language, and presented the man with a piece of silver. For the moment the effect was quite satisfactory, and with a rueful but resigned air the poor fellow followed the upward track. Presently the second man appeared, panting with the rapid climb, and addressed himself to me with equal energy. I replied in the same strain that had quieted the resistance of his companion, and with a similar result. Botanizing was now pretty nearly out of the question; it was snowing fast, and a violent wind had arisen, so that for the remainder of the way we collected nothing but a few plants growing on ledges of rock where the snow had not lodged. The last part of the ascent was up a broad couloir, on débris lying at a high angle between steep rocks on either hand; but the mule track was well engineered, and carried up a regular zig-zag nowhere inconveniently steep.

By this time the cold had become intense. My guide, if I am to give him that name, over and over again appealed to me in language quite as intelligible as if he had spoken English, or I had understood his native Schleuh. I own that I found something pathetic in his earnestness as he repeatedly kissed the hem of my 'jellabiah,' and explained that it was not only the present suffering but the future consequences to himself of our adventure that he dreaded. The poor fellow's bare legs were cut and bleeding, and, in his scanty dress, he was evidently suffering severely. Presently I heard shouts through the howling of the wind, and a few moments after Mr. Maw re-appeared descending towards me. He had been on the top of the pass, about 100 feet above the spot where we stood. The ridge was level for 10 or 12 yards, and then appeared to descend on the opposite side. He was able to see absolutely nothing, and found the cold and the violent wind quite unbearable. This I was quite ready to believe, for in spite of the active exertion I found myself near the limit of what I could bear. I was quite ready to forego the honour of the last hundred feet; and when we joined Dr. Hooker, who was about fifty feet below me, he displayed the same forbearing spirit.

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I don't know what my appearance may have been, but I can testify that that of my companions was decidedly peculiar. Their hair and beards were completely matted with ice, and the blackish-red aspect of their faces would have disguised them from their nearest friends.

As we descended, we found that the snow had fallen nearly to the level of the shed where our attendants had patiently sat, not sorry to enjoy its shelter. We were told that the Sheik was waiting for us a little way down the valley, and we pushed on to the spot. Food of some kind was provided, but for my part I was too wet and cold to feel disposed for more than a mouthful; and, as soon as I decently could do so, I pushed on to our temporary home at Arround.

On the preceding day we had agreed that, if all went well on our first excursion, we should make a serious attempt to induce our Sheik to let us have a second day's mountaineering in the Atlas, with the hope of gaining some peak and getting a bird's-eye view over the unknown region to the south. But that project, like many of a mountaineer's best projects, was settled in the negative by the elements. It snowed heavily all night, and in the morning the mountains were completely covered to within a few hundred feet of the village, save where the rocks rose too steep for snow to rest, and we made up our minds to return to our camp. Disappointed as mountaineers, but consoled as botanists by the rich booty that we had managed to store up, we set our faces once more down the valley. It was fortunate for us that snow and not rain had fallen on the mountains, and that the heavy clouds still kept the valley in shade. As it was, the passage of the torrent was not quite easy. There are no bridges in Morocco, and it is quite a common occurrence, even on frequented roads, to wait several days before it is possible to ford a stream. Our camp presented a dismal appearance. Our tents had been pitched in a fallow field almost bare of vegetation, but the rain of the last thirty-six hours had turned the surface into one mass of slimy mud, and the wet had soaked in under the tents, so that there was scarcely a single dry spot to be found. Such a state of things is not pleasant to ordinary travellers, but to botanists it is little less than a calamity.

I might here end this short account of our mountaineering experiences in the Great Atlas, but a regard for the good repute of a region not yet familiar to travellers makes me say that the outbreak of bad weather which we encountered on the 15th and 16th of May was followed by a delightfully clear and brilliant sky. Six days after our ascent to the Tag-

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herot Pass, Dr. Hooker and I—Mr. Maw having meantime returned to England—reached the summit of Djebel Tezah, a conspicuous peak about 11,400 feet in height, in a lower part of the main range, and some forty miles nearer to the coast. As before, our guide on that occasion was commissioned to prevent us from reaching the summit; but, either because he had not such good legs, or because climbing was rather severe work under a blazing sun only a few degrees from the zenith, he took the sensible course of resting under a rock, and left the infidels to their own devices. In due time we stood on the peak, with no one to interfere with our enjoyment of a view never before gained by Europeans. The existence of a great mountain valley, enclosed between the main range of the Great Atlas, and a parallel southern chain, which may be called the Anti-Atlas, and watered by the upper stream of the Sous, had indeed been established by Gerhard Rohlfs, who had traversed the lower part of it; but we actually looked across it, and saw, in the southern horizon, at a distance of some forty miles, the heaving outline of the Anti-Atlas, contrasting remarkably with the peaked and jagged aspect of the main chain. We roughly estimated the height of the portion lying opposite to us at about 10,000 feet.

On the 19th we had obtained a fine view of the main range, deeply clad in snow from about the level of 7,500 feet; but four days later—so quickly does the nearly vertical African sun accomplish its work—we found only a few large patches where the snow had drifted on the flanks of Djebel Tezah, and the topmost ridge was completely bare. The ascent was perfectly easy, the form of the mountain being somewhat like that of the Mole near Bonneville, familiar to Chamouni tourists.

Enough has been said to show the members of the Alpine Club that at no great distance from home there is a range of mountains rivalling in height the loftiest of our European mountain chains, and all but utterly unexplored. The fact that the most accessible pass in the district due south of the city of Morocco is as nearly as possible 12,000 ft. above the sea, makes it probable that I am not far wrong in estimating the height of the more conspicuous summits which we saw at about 14,000 English feet; but the concurrence of native testimony to the existence of mountains white in summer in the more eastern portion of the chain makes it highly probable that there are peaks yet unseen by travellers that rival, if they do not exceed, the giants of the European Alps.

In point of accessibility, however, the Great Atlas presents

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a curious contrast to other portions of the African continent. The difficulties and dangers that beset a traveller in Eastern Africa arise from the climate and the natural obstacles; but the rude races of the country do not appear to have any fixed antipathy to strangers, or where they have such feelings they are subject to the ascendancy which a white man of ordinary determination and coolness can exert over utterly uncivilised people. In Morocco the climate is admirable; the natural obstacles of no account, but the traditional policy of the ruling race has passed into the very fibre of the inhabitants, and affords an obstacle all but impassable to ordinary travellers. The Government is so far centralised that in the parts of the country subject to the Sultan's authority no local chief would dare, even if he were so disposed, to harbour a foreigner without the permission of the higher powers; and even when this had been obtained, we learned by experience that a complete network of obstacles arising from the active or passive resistance of subordinate officials remains to be broken through.

The partial success which we obtained has naturally led some travellers to follow on our footsteps. An English gentleman, relying on the influence of some of the foreign consuls, has visited the city of Morocco, with the intention of endeavouring to travel farther into the country, but finding that his food was poisoned by the order, or with the connivance of the governor of the city, he judiciously abandoned the attempt. Two German travellers were more fortunate. Through the good offices of Sir John Drummond Hay they obtained from the Sultan an order of the same kind as that which was granted to Dr. Hooker; and after encountering difficulties similar in character to those met by us, they appear to have penetrated the same valley of Aït Mesan, and, as I understand, attained under more favourable conditions than we did the summit of the Tagherot Pass.

It is possible that the relaxation of the policy of exclusion, which appears to have commenced in Morocco, may gradually be extended, but I do not expect that so great a change will be carried out rapidly in a country which has been not inappropriately styled 'the China of the West.'

Barriers of all kinds are yielding to influences that penetrate, however slowly, beyond the pale of European civilisation; and it is, perhaps, not too much to hope that some of the younger members of the Alpine Club may explore that lofty and altogether unknown region that lies eastward of the ancient capital of Morocco, and set foot on snowy peaks whose very existence is still an unsolved problem.

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