

The Swamp was upside down

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Published: 1956
in »Astounding Science Fiction«



I

Hardwick knew the Survey ship had turned end-for-end, because though there was artificial gravity, it does not affect the semicircular canals of the human ear. He knew he was turning head-over-heels, even though his feet stayed firmly on the floor. It was not a normal sensation, and he felt that queasy, instinctive tightening of the muscles with which one reacts to the abnormal, whether in things seen or felt.

But the reason for turning the ship end-for-end was obvious. It had arrived very near its destination, and was killing its Lawlor-drive momentum. Just as Hardwick was assured that the turning motion was finished, young Barnes—the

ship's lowest-ranking commissioned officer—came into the wardroom and beamed at him kindly.

"The ship's not landing, sir," he said gently, like one explaining something to somebody under ten years old. "Our orders are changed. You're to go to ground by boat. This way, sir."

Hardwick shrugged. He was a Senior Officer of the Colonial Survey, and this was a Survey ship, and it had been sent especially to get him from his last and still unfinished job. It was a top-urgency matter. This ship had had no other business for some months except to go after and bring him to Sector Headquarters, down on Canna III which must be somewhere near. But this young officer was patronizing him!

Hardwick rather regretfully recognized that he didn't know how to be impressive. He was not a good salesman of his own importance. He didn't even get the urgent respect due his rank—and when one thought about it, it was amazing that he'd ever reached a high level in the Survey.

Illustration

Now the young officer waited, brisk and kindly and blandly alert in manner. Hardwick reflected wryly that he could pin young Barnes' ears back easily enough. But he remembered when he'd been a junior Survey ship's officer. Then he'd felt a serene condescension toward all people of whatever rank who did not spend their lives in the cramped, skimped quarters of a Survey patrol-ship. If this young Lieutenant Barnes were fortunate, he'd always feel that way. Hardwick could not begrudge him the cockiness which made the tedium and hardships of the Service seem to him a privilege.

So he quite obediently followed Barnes through the wardroom door. He ducked his head under a ventilation slot and sidled past a standpipe with bristling air-valve handles. It almost closed the way. There was the smell of oil and paint and ozone which all proper Survey ships maintain in their working sections.

"Here, sir," said Barnes paternally. "This way."

He offered his arm for Hardwick to steady himself by. Hardwick ignored it. He stepped over a complex of white-painted pipes. He arrived at an almost clear way to a boat-blister.

"And your luggage, sir," added the young man reassuringly, "will follow you down immediately, sir. With the mail."

Hardwick nodded. He moved toward the blister door. He practically edged past constrictions due to new equipment. The Survey ship had been designed a long time ago, and there were no funds for rebuilding when improved devices came along. So any Survey ship was apt to be cluttered up with afterthoughts in metal.

A speaker from the wall said sharply:

"Hear this! Hold fast! Gravity going off!"

Hardwick caught at a nearby pipe, and snatched his hand away again—it was hot—and caught on to another and then put his other hand below. He applied a trifle of pressure. The young officer said kindly:

"Hold fast, sir. The ship's gravity is going off. If I may suggest—"

The gravity did go off. Hardwick grimaced. There'd been a time when he was used to such matters. This time the sudden outward surge of his breath caught him unprepared. His diaphragm contracted as the weight of organs above it ceased to be. He choked for an instant. He was irritated. He said evenly:

"I am not likely to go head-over-heels, lieutenant. I served four years as a junior swot on a ship exactly like this!"

He did not float about. He held onto a pipe in two places, and he applied expert pressure in a strictly professional manner, and his feet remained firmly on the floor. He startled young Barnes by the achievement, which only junior swots think only junior swots know about.

Barnes said, abashed:

"Yes, sir." He held himself firm in the same fashion.

"I even know," said Hardwick crisply, "that the gravity had to be cut off because we're approaching another ship on Lawlor-drive. Our gravity-coils would blow if we got into her field with our drive off, or if her field pressed ours inboard."

Young Barnes looked extremely uncomfortable. Hardwick felt sorry for him. To be chewed—however delicately—for patronizing a senior officer could not be pleasant. So Hardwick added:

"And I also remember that, when I was a junior swot I once tried to tell a Sector Chief how to top off his suit-tanks. So don't let it bother you!"

The young officer was embarrassed. But a Sector Chief was so high in the table of Survey organization that one of his idle thoughts was popularly supposed to be able to crack a junior officer's skull. If Hardwick, as a young officer, had really tried to tell a Sector Chief how to top his suit-tanks... Why...

"Thank you, sir," said Barnes awkwardly. "I'll try not to be an ass again, sir."

"I suspect," said Hardwick, "that you'll slip occasionally. I did! What the devil's another ship doing out here and why aren't we landing?"

"I wouldn't know, sir," said the young officer respectfully. His manner toward Hardwick was quite changed. "I do know the Skipper came in expecting to land, sir, by the landing-grid, sir. He was told to stand off. He's as much surprised as you are, sir."

The wall-speaker said crisply:

"Hear this! Gravity returning! Gravity returning!"

And weight came back. Hardwick was ready for it this time and took it casually. He looked at the speaker and it said nothing more. He nodded to the young man.

"I suppose I'd better get in the boat. No change in that arrangement, anyhow!"

He crawled through the blister door and wormed his way into the landing-boat—designed for a more modern ship, and excessively inconvenient in such an outmoded launching-device. Barnes crawled in after him.

"Excuse me, sir. I'm to take you down."

He dogged the blister door from the inside, closed the boatport and dogged it, and flipped a switch.

"Ready for departure," he said into a microphone.

A dial on the instrument board flicked halfway to zero. It stopped there. Seconds passed. A green light glowed. The young officer said:

"All tight!"

The needle darted a quarter-way farther over, and then began to descend slowly. The blister was being pumped empty of air. Presently another light glowed.

"Ready for launching," said the young officer briskly.

There were clankings. The blister-seal broke, and the two halves of the boat cover drew back. There were stars. To Hardwick they were unfamiliarly arranged, but he could have picked out Seton and the Donis cluster in any case, and half a hundred more markers by taking thought of the position of the planet Canna III, on which Colonial Survey Sector Headquarters for this part of the galaxy were established.

The boat moved gently out of its place and the ship's gravity field ended as abruptly as such fields do.

The Survey ship floated away, as seen from the vision ports of the boat. It apparently increased its drive, because the boat swirled and swayed as changing eddy-currents moved it. The ship grew small and vanished. The boat hung in emptiness, turning slowly. The sun Canna came into view. It was very large for a Sol-type sun, and its rim was almost devoid of the prominences and jet streams of flaming gas that older suns of the type display. But even out at the third orbit it provided 0-1 climate—optimum: equivalent to Earth—for the planet below.

That planet now came swinging into view as the ship's boat continued to turn. It was blue. More than ninety per cent of its surface was water, and much of the solid land was under the northern ice cap. It had been chosen as Sector Headquarters because of its unsuitability for a large population, which might resent the considerable land-area needed for Survey storage and reserve facilities.

Hardwick regarded it thoughtfully. The boat was, of course, roughly five planetary diameters out—the conventional distance to which a ship approached any planet on its own drive. Hardwick could see the ice cap very clearly, and blue sea beyond it and the twilight-line. There was one cyclonic storm just dissipating toward the night-side, and the edge of a similar cloud-system down toward the equator. Hardwick searched for Headquarters. It was on an island at about forty-five degrees latitude, which ought to be near the center of the planet's surface as seen from where the ship's boat floated. But he could not make it out. There was only the one island of any importance and it was not large.

Nothing happened. The boat's rockets remained silent. The young officer sat quietly, looking at the instruments before him. He seemed to be waiting for something to happen.

A needle kicked and stayed just off the pin. It was an external-field indicator. Some field, somewhere, now included the space in which the ship's boat floated.

"Hm-m-m," said Hardwick. "You are waiting for orders?"

"Yes, sir," said the young man. "I'm ordered not to land except under ground instructions, sir. I don't know why."

Hardwick observed detachedly:

"One of the worst wiggings I ever got was in a boat like this. I was waiting for orders and they didn't come. I acted very Service about it: stiff upper lip and all that. But I was getting in serious trouble when it occurred to me that it might be my fault I wasn't getting the orders."

The young officer glanced quickly at an instrument he had previously ignored. Then he said relievedly:

"Not this time, sir. The communicator's turned on, all right."

Hardwick said:

"Do you think they might be calling you without shifting from ship-frequency? They were talking to the ship, you know."

"I'll try, sir."

The young man leaned forward and switched to ship-band adjustment of the communicator. Different wave bands, naturally, were used between a ship and shore, and a ship and its own boats. A booming carrier wave came in instantly. The young officer hastily turned down the volume and words became distinguishable.

"...What the devil's the matter with you? Acknowledge!"

The young officer gulped. Hardwick said mildly:

"Since he ranks you, just say 'Sorry, sir.'"

"S-sorry, sir," said Barnes into the microphone.

"Sorry?" snapped the voice from the ground. *"I've been calling for five minutes! Your skipper will hear about this! I shall—"*

Hardwick pulled the microphone before him.

"My name is Hardwick," he observed, "I am waiting for instructions to land. My pilot has been listening on boat-frequency, as was proper. You appear to be calling us on an improper channel. Really—"

There was stricken silence. Then babbled apologies from the speaker. Hardwick smiled faintly at young Barnes.

"It's quite all right. Let's forget it now. But will you give my pilot his instructions?"

The voice said strainedly:

"You're to be brought down by landing-grid, sir. Rocket landings have been ruled non-permitted by the Sector Chief himself, sir. But we are already landing one boat, sir. Senior Officer Werner is being brought in now, sir. His boat is still two diameters out, sir, and it will take us nearly an hour to get him down without extreme discomfort, sir."

"Then we'll wait," said Hardwick. "Hm-m-m. Call us again before you start hunting us with the landing-beam. My pilot has a rather promising idea. And will you call us on the proper frequency then, please?"

The voice aground said unhappily:

"Yes, sir. Certainly, sir."

The carrier-wave hum stopped. Young Barnes said gratefully:

"Thank you, sir! Hell hath no fury like a ranking officer caught in a blunder! He'd have twisted my tail for his mistake, sir, and it could have been bad!" Then he paused. He said uneasily, "But... beg pardon, sir! I haven't any promising ideas. Not that I know of!"

"You have an hour to develop one," Hardwick told him.

Internally, Hardwick was disturbed. There were few occasions on which even one Senior Officer was called in to Sector Headquarters. Interstellar distances being what they were, and thirty light-speeds being practically the best available, Senior Officers necessarily acted pretty much as independent authorities. To call one man in meant all his other work had to go by the board for a matter of months. But two—And Werner?

Werner was getting to ground first. If there were something serious ashore, Werner would make a great point of arriving first, even if only by hours. A keen sort of person in giving the right impression, he'd risen in the Service faster than Hardwick. That other Lawlor field would have been his ship getting out of the way.

The young officer at his elbow fidgeted.

"Beg pardon, sir. What sort of idea should I develop, sir? I'm not sure I understand—"

"It's rather annoying to have to stay parked in free fall," said Hardwick patiently. "And it's always a good practice to review annoying situations and see if they can be bettered."

Barnes' forehead wrinkled.

"We could land much quicker on rockets, sir. And... even when the landing-grid reaches out for us, since we've no gravity-coils, they'll have to handle us very cautiously or they'd break our necks!"

Hardwick nodded. Barnes was thinking straight enough, but it takes young officers a long time to think of thinking straight. They have to obey so many orders unquestioningly that they tend to stop doing anything else. Yet at each rise in grade some slight trace of increased capacity to think is required. In order to reach really high rank, an officer has to be capable of thinking which simply isn't possible unless he's kept in practice on the way up.

Young Barnes looked up, startled.

"Look here, sir!" he said, surprised. "If it takes them an hour to let down Senior Officer Werner from two planetary diameters, it'll take much longer to let us down from out here!"

"True," said Hardwick.

"And you don't want to spend three hours descending, sir, after waiting an hour for him!"

"I don't," admitted Hardwick. He could have given orders, of course. But if a junior officer were spurred to the practice of thinking, it might mean that some day he'd be a better senior officer. And Hardwick knew how desperately few men were really adequate for high authority. Anything that could be done to increase the number—

Young Barnes blinked.

"But it doesn't matter to the landing-grid how far out we are!" he said in an astonished voice. "They could lock on to us at ten diameters, or at one! Once they lock the field-focus on us, when they move it they move us!"

Hardwick nodded again.

"So... so by the time they've got that other boat landed... why... I can use rockets and get down to one diameter myself, sir! And they can lock onto us there and let us down a few thousand miles only! So we can get to ground half an hour after the other boat's down instead of four hours from now."

"Just so," agreed Hardwick. "At a cost of a little thought and a little fuel. You do have a promising idea after all, lieutenant. Suppose you carry it out?"

Young Barnes glanced at Hardwick's safety-strap. He threw over the fuel-ready lever and conscientiously waited the conventional few seconds for the first molecules of fuel to be catalyzed cold. Once firing started, they'd be warmed to detonation-readiness in the last few millimeters of the injection-gap.

"Firing, sir," he said respectfully.

There was the curious sound of a rocket blasting in emptiness, when the sound is conveyed only by the rocket-tube's metal. There was the smooth, pushing sensation of acceleration. The tiny ship's boat swung and aimed down at the planet. Lieutenant Barnes leaned forward and punched the ship's computer.

"I hope you'll excuse me, sir," he said awkwardly. "I should have thought that out myself, sir, without prompting. But problems like this don't turn up very often, sir. As a rule it's wisest to follow precedents as if they were orders."

Hardwick said dryly:

"To be sure! But one reason for the existence of junior officers is the fact that some day there will have to be new senior ones."

Barnes considered. Then he said surprisedly:

"I never thought of it that way, sir. Thank you."

He continued to punch the computer keys, frowning. Hardwick relaxed in his seat, held there by the gentle acceleration and the belt. He'd had nothing by which to judge the reason for his summoning to Headquarters. He had very little now. But there was trouble of some sort below. Two senior officers dragged from their own work. Werner, now—Hardwick preferred not to estimate Werner. He disliked the man, and would be biased. But he was able, though definitely on the make. And there was himself. They'd been called to Headquarters where no ship was to be landed by landing-grid, nor any rocket to come to ground. A landing-grid could pluck a ship out of space ten planet-diameters out, and draw it with gentle violence shoreward, and land it lightly as a feather. A landing-grid could take the heaviest, loaded freighter and stop it in orbit and bring it down at eight gravities. But the one below wouldn't land even a tiny Survey ship! And a landing-boat was forbidden to come down on its rockets!

Hardwick arranged those items in his mind. He knew the planet below, of course. When he got his Senior rating he'd spent six months at Headquarters learning procedures and practices proper to his increased authority. There was one inhabitable island, two hundred miles long and possibly forty wide. There was no other usable ground outside the Arctic.

The one occupied island had gigantic sheer cliffs on its windward side, where a great slab of bedrock had split along some submarine fault and tilted upward above the surface. Those cliffs were four thousand feet high, but from them the island sloped very, very gently and very gradually until its leeward shore slipped under the restless sea.

Sector Headquarters had been placed here because it seemed that civilians would not want to colonize so limited a world. But there were civilians, because there was Headquarters. And now every inch of ground was cultivated and there was irrigation and intensive farming and some hydroponic establishments. But Sector Headquarters included a vast reserve area on which a space-fleet might be marshaled in case of need. The overcrowded civilians were bitter because of the great uncultivated area the Survey needed for storage and possible emergency use. Even when Hardwick was here, years back, there was bitterness because the Survey crowded the civilian economy which had been based on it.

Hardwick considered all these items. He came to an uncomfortable conclusion. Presently he looked up. The planet loomed larger. Much larger.

"I think you'd better lose all planetward velocity before we hook on," he observed. "The landing-grid crew might have trouble focusing on us so close if we're moving."

"Yes, sir," said the young officer. "I will, sir."

"There's some sort of merry hell below," said Hardwick wryly. "It looks bad that they won't let a ship come down by grid. It looks worse that they won't let this one land on its rockets." He paused. "I doubt they'll risk lifting us off again."

Young Barnes finished his computations. He looked satisfied. He glanced at the now-gigantic planet below. He deftly adjusted the course of the tiny boat. Then he jerked his head around.

"Excuse me, sir. Did you say we mightn't be able to lift off again?"

"I could almost predict that we won't," said Hardwick.

"Would you... could you say why, sir?"

"They don't want landings. The trouble is here. If they don't want landings, they won't want launchings. Werner and I were sent for, so presumably we're needed. But apparently there's uneasiness about even our landing. Surely they won't send us off again. I suspect—"

The loud-speaker said tinnily:

"Calling boat from landing-grid! Calling boat from landing-grid!"

"Come in," said Barnes. But he looked uneasily at Hardwick.

"Correct your course!" commanded the voice sharply. *"You are not to land on rockets under any circumstances! This is an order from the Sector Chief himself! Stand off! We will be ready to lock on and land you gently in about fifteen minutes. But meanwhile stand off!"*

"Yes, sir," said young Barnes.

Hardwick reached over and took the microphone.

"Hardwick speaking," he said. "I'd like information. What's the trouble down there that we can't use our rockets?"

"Rockets are noisy, sir. Even boat-rockets. We have orders to prevent all physical vibration possible, sir. But I am ordered not to give details on a transmitter, sir."

"I'll sign off," said Hardwick, dryly.

He pushed the microphone away. He deplored his own lack of aggressiveness. Werner, now, would have pulled his rank and insisted on being informed. But Hardwick couldn't help believing that there was a reason for orders that over-ruled his own.

The young officer swung the rocket end-for-end. The sensation of pressure against the back of Hardwick's seat increased.

Minutes later the speaker said:

"Grid to boat. Prepare for lock-on."

"Ready, sir," said Barnes.

The small boat shuddered and leaped crazily. It spun. It oscillated violently through seconds-long arcs in emptiness. Very, very gradually, the oscillations died. There was a momentary sensation of the faint tugging of planetary weight, which is somehow subtly different from the feel of artificial gravity. Then the cosmos turned upside down as the boat was drawn very swiftly toward the watery planet below it.

Some minutes later, young Barnes spoke apologetically:

"Beg pardon, sir," he said diffidently. "I must be stupid, sir, but I can't imagine any reason why vibrations or noise should make any difference on a planet. How could it do harm?"

"This is an ocean-planet," said Hardwick. "It might make people drown."

The young officer flushed. He turned his head away. And Hardwick reflected ruefully that the young were always sensitive. But he did not speak again. When they landed in the vast, spidery landing-grid—a vast metal grid-work a full half-mile high—Barnes would find out whether he was right or not.

He did. And Hardwick was right. The people on Canna III were anxious to avoid vibrations because they were afraid of drowning.

Their fears seemed to be rather well-founded.

II

Three hours after landing, Hardwick moved gingerly over grayish muddy rock, with a four-thousand-foot sheer drop some twenty yards away. The ragged edge of a cliff fell straight down for the better part of a mile. Far below, the sea rippled gently. Hardwick saw a long, long line of boats moving slowly out to sea. They towed something between them which reached from boat to boat in exaggerated catenary curves. The boats moved in line abreast straight out from the cliffs, towing this floating, curved thing between them.

Illustration

Hardwick regarded them for a moment and then inspected the grayish mud underfoot. He lifted his eyes to the inland side of this peculiar stretch of mountainside muddiness. There was a mast on the rock not far away. It held up what looked like a vision-camera.

Young Barnes said:

"Excuse me, sir. What are those boats doing?"

"They're towing an oil-slick out to sea," said Hardwick absently, "by towing a floating line of some sort between them. There isn't enough oil to maintain the slick, and it's blown landward. So they tow it out to sea again. It holds down the seas. Every time, of course, they lose some of it."

"But—"

"There are trade winds," said Hardwick, not looking to seaward at all. "They always blow in the same direction, nearly. They blow three-quarters of the way around the planet, and they build up seas as they blow. Normally, the swells that pound against this cliff, here, will be a hundred feet and more from crest to crest. They'll throw spray ten times that high, of course, and once when I was here before, spray came over the cliff-top. The impacts of the waves are—heavy. In a storm, if you put your ear to the ground on the leeward shore, you can hear the waves smash against these cliffs. It's vibration."

Barnes looked uneasily at the cliff's edge and the line of boats pushing sturdily over an ocean whose waves seemed less than ripples from nearly a mile above

them. But the line of boats was incredibly long. It was twenty miles in length at the least, and between each two boats there was the long curved line of something being towed on the surface.

"The... slick holds down the waves," Barnes guessed. "It... works best in deep water, I believe. The ancients knew it. Oil on the waters." He considered. "Working hard to prevent vibrations! Are they really so dangerous, sir?"

Hardwick nodded inland. And, at a quarter-mile from the edge of the cliff there was a peculiar, broken, riven rampart of soil. It might have been forty feet high, once. Now it was shattered and cracked. It had the quite incredible look of having been pulled away from where Hardwick stood, and of having partly disintegrated as it was withdrawn. There were vertical breaks in its edges. There were broken-off masses left behind. At one place a clump of perhaps a quarter-acre had not followed the rest, and trees leaned drunkenly from its top, and at the edge had fallen outward. And all along the top of the stone cliff for as far as the eye could see there was this singular retreat of soil and vegetation from the cliff's edge.

Hardwick stooped and picked up a bit of the mud underfoot. He rubbed it between his fingers. It yielded like modeling clay. He dipped a finger into a gray, greasy-seeming puddle. He looked at the thick liquid on his finger and then rubbed it against his other palm. Young Barnes duplicated this last action.

"It... feels soapy, sir!" he said blankly. "Like... wet soap!"

"Yes," said Hardwick. "That's the first problem here."

He turned to a ground-service Survey private. He jerked his head along the coast line.

"How much have other places slipped?"

"Anywhere from this much, sir," said the private, "to two miles and upward. There's one place where it's moving at a regular rate. Four inches an hour, sir. It was three-and-a-half yesterday."

Hardwick nodded.

"Hm-m-m. We'll go back to Headquarters. Nasty business!"

He plodded over the extraordinarily messy footing toward the vehicle which had brought him here. It was not an ordinary ground-car. Instead of tires or caterwheels, it rolled upon flaccid, partly-inflated five-foot rollers. They would be completely unaffected by roughness or slipperiness of terrain, and if the vehicle fell overboard it would float. But it was thickly coated with the gray mud of this cliff-top.

As he moved along, Hardwick was able to see the pattern of the rock underneath the mud. It was curiously contorted, like something that had curdled rather than cooled. And, as a matter of fact, it was believed to have solidified slowly under water at such monstrous pressure that even molten rock could not make it burst into steam. But it was above-water now.

Hardwick climbed into the vehicle, and Barnes followed him. The bolster-truck turned. It moved toward the broken barrier of earth. Its five-foot flabby rollers seemed rather to flow over than to surmount obstacles. Great lumps of drier dirt dented them and did not disintegrate. There were no stones.

Hardwick frowned to himself. The bolster-truck more or less flowed up the crumbling, inexplicably drawing-back mass of soil. Atop it, things looked almost normal. Almost. There was a highway leading away from the cliff. At first glance it

seemed perfect. But it was cracked down the middle for a hundred yards, and then the crack meandered off to the side and was gone. There was a great tree, which leaned drunkenly. A mile along the roadway its surface buckled as if something had pressed irresistibly upward from below. The truck rolled over the break.

It was notable that the motion of the truck was utterly smooth. It made no vibration at all. But even so it slowed before it moved through a place where houses—dwellings and a shop or two—clustered closely together on each side of the road.

There were people in and about the houses, but they were doing nothing at all. Some of them stared hostilely at the Survey truck. Some others deliberately turned their backs to it. There were vehicles out of shelter and ready to be used, but none was moving. All—very oddly—were pointed in the direction from which the bolster-truck had come.

The truck went on. Presently the extraordinary flatness of the landscape became apparent. It was possible to see a seemingly illimitable distance. The ocean forty miles away showed as a thread of blue beneath the horizon. The island was an almost perfectly plane surface. But the windward side was tilted up to a height of four thousand feet above the sea, and the downwind side slipped gently beneath the waves. There was no hill visible anywhere. No mountains. No valleys save the extremely minor gullies worn by rain. Even they had been filled in, or dammed, and tied in to irrigation systems.

There was a place where there was a row of trees along such a water-course. Half the row was fallen, and a part of the rest was tilted. The remainder stood upright and firm. All the vegetation was perfectly familiar. Most colonies have some vegetation, at least, directly descended from the mother planet Earth. But this island on Canna III had been above-water perhaps no more than three or four thousand years. There had been no time for local vegetation to develop. When the Survey took it over, there was only tidal seaweed, only one variety of which had been able to extend itself in web-like fashion over the soil above water. Terrestrial plants had wiped it out, and everything was green, and everything was human-introduced.

But there was something wrong with the ground. At this place the top of the soil bulged, and tall corn-plants grew extravagantly in different directions. There, there was a narrow, lipless gap in the ground's surface. An irrigation-ditch poured water into it. It was not filled.

Barnes said distressedly:

"Excuse me, sir, but how the devil did this happen?"

"There's been irrigation," said Hardwick patiently. "The soil here was all ocean-bottom, once—it used to be what is called globigerinous ooze. There's no sand. There are no stones. There's only bedrock and formerly abyssal mud. And—some of it underneath is no longer former. It's globigerinous ooze again."

He waved his hand at the landscape. It had been remarkably tidy, once. Every square foot of ground had been cultivated. The highways were of limited width, and the houses were neat and trim. It was, perhaps, the most completely civilized landscape in the galaxy. But Hardwick added:

"You said the stuff felt like soap. In a way it's acting like soap. It lies on slightly slanting, effectively smooth rock, like a soap-cake on a slightly slanting sheet of metal. And that's the trouble. So long as a cake of soap is dry on the bottom it doesn't move. Even if you pour water on top, like rain, the top will wet, and the water will flow off, but the bottom won't wet until all the soap is dissolved away. While that was the process here, everything was all right. But they've been irrigating."

They passed a row of neat cottages facing the road. One had collapsed completely. The others looked absolutely normal. The bolster-truck went on.

Hardwick said, frowning:

"They wanted the water to go into the soil. So they arranged it. A little of that did no harm. Plants growing dried it out again. One tree evaporates thousands of gallons a day in a good trade wind. There were some landslides in the early days, especially when storm-swells pounded the cliffs, but on the whole the ground was more firmly anchored when first cultivated than it had been before the colonists came."

"But—irrigation? The sea's not fresh, is it?"

"Water-freshening plants," said Hardwick dryly. "Ion-exchange systems. They installed them and had all the fresh water they could wish for. And they wished for a lot. They deep-plowed, so the water would sink in. They dammed the water-courses—and it sank in. What they did amounted to something like boring holes in the cake of soap I used for an illustration just now. Water went right down to the bottom. What would happen then?"

Barnes said:

"Why... the bottom would wet... and slide! As if it were greased!"

"Not greased," corrected Hardwick. "Soaped. Soap is viscous. That is different—and a lucky difference! But the least vibration would encourage movement. And it does. It has. So the population is now walking on eggs. Worse, it's walking on the equivalent of a cake of soap which is getting wetter and wetter on the bottom. It's already sliding as a viscous substance does—reluctantly. But in spite of the oil-slick they're trying to keep in place upwind there's still some battering from the sea. There are still some vibrations in the bedrock. And so there's a slow, and gentle, and gradual sliding."

"And they figure," said Barnes abruptly, "that locking onto a ship with the landing-grid might be like an earthquake." He stopped. "An earthquake, now—"

"Not much vulcanism on this planet," Hardwick told him. "But of course there are tectonic quakes occasionally. They made this island."

Barnes said uneasily:

"I don't think, sir, that I'd sleep well if I lived here."

"You are living here for the moment. But at your age I think you'll sleep."

The bolster-truck turned, following the highway. The road was very even, and the motion of the truck along it was infinitely smooth. Its lack of vibration explained why it was permitted to move when all other vehicles were stopped. But Hardwick reflected uneasily that this did not account for the orders of the Sector Chief forbidding the rocket-landing of a ship's boat. It was true enough that the living-surface of the island rested upon slanting stone, and that if the bottom were wet enough it could slide off into the sea. It already had moved. At least one place

was moving at four inches per hour. But that was viscous flow. It would be enhanced by vibration, and assuredly the hammering of seas upon the windward cliff should be lessened by any possible means.

But it did not mean that the sound of a rocket-landing would be disastrous, nor that the straining of a landing-grid as it stopped a space-ship in orbit and drew it to ground should produce a landslide. There was something else—though the situation for the island's civilian population was assuredly serious enough. If any really massive movement of the ground did begin, viscous or any other; if any considerable part of the island's surface did begin to move—all of it would go. And the population would go with it. If there were survivors, they could be numbered in dozens.

The tall tamped-earth wall of the Headquarters reserve area loomed ahead. Sector Headquarters had been established here when there were no other inhabitants. Seeds had been broadcast and trees planted while the survey buildings were under construction. Headquarters, in fact, had been built upon an uninhabited planet. But colonists followed in the wake of Survey personnel. Wives and children, and then storekeepers and agriculturists, and presently civilian technicians and ultimately even politicians arrived as the non-Service population grew. Now Sector Headquarters was resented because it occupied one fourth of the island. It kept too much of the planet's useful surface out of civilian use. And the island was now desperately overcrowded.

But it seemed also to be doomed.

As the bolster-truck moved silently toward Headquarters, a hundred-yard section of the wall collapsed. There was an upsurging of dust. There was a rumbling of falling, hardened wall. The truck's driver turned white. A civilian beside the road faced the wall and wrung his hands, and stood waiting to feel the ground under his feet begin to sweep smoothly toward the here-distant sea. A post held up a traffic signal some twenty yards from the gate. It leaned slowly. At a forty-five-degree tilt it checked and hung stationary. Fifty yards from the gate, a new crack appeared across the road.

But nothing more happened. Nothing. Yet one could not be sure that some critical point had not been passed, so that from now on there would be a gradual rise in the creeping of the soil toward the ocean.

Barnes caught his breath.

"That—makes one feel queer," he said unsteadily. "A... shock like that wall falling could start everything off!"

Hardwick said nothing at all. It had occurred to him that there was no irrigation of the Survey area. He frowned very thoughtfully—even worriedly, as the truck went inside the Headquarters gate and rolled smoothly on over a winding road through definitely parklike surroundings.

It stopped before the building which was the Sector Chief's own headquarters in Headquarters. A large brown dog dozed peacefully on the plastic-tiled landing at the top of half a dozen steps. When Hardwick got out of the truck the dog got up with a leisurely air. When Hardwick ascended the steps, with Barnes following him, the dog came forward with a sort of stately courtesy to do the honors. Hardwick said:

"Nice dog, that."

He went inside. The dog sedately followed. The interior of the building was singularly empty. There was a sort of resonant silence until somewhere a telewriter began to click.

"Come along," said Hardwick. "The Sector Chief's office is over this way."

Young Barnes followed uncomfortably.

"It seems odd there's no one around. No secretaries, no sentries, nobody at all."

"Why should there be?" asked Hardwick in surprise. "The guards at the gate keep civilians out. And nobody in the Service will bother the Chief without reason. At least, not more than once!"

But across a glistening, empty floor there ran an ominous crack.

They went down a corridor. Voices sounded, and Hardwick tracked them, with the paws of the dog clicking on the floor behind him. He led the way into a spacious, comfortably nondescript room with high windows—doors, really—that opened on green lawn outside. The Sector Chief, Sandringham, leaned placidly back in a chair, smoking. Werner, the other summoned Senior Officer, sat bolt upright in a chair facing him. Sandringham waved a hand cordially to Hardwick.

"Back so soon? You're ahead of schedule on all counts! Here's Werner, back from looking at the fuel-store situation."

Hardwick suddenly looked as if he'd been jolted. But he nodded, and Werner tried to smile and failed. He was completely white.

"My pilot from the ship, who's kept aground," said Hardwick. "Lieutenant Barnes. Very promising young officer. Cut my landing-time by hours. Lieutenant, this is Sector Chief Sandringham and Mr. Werner."

"Have a seat, Hardwick," grunted the Chief. "You, too, lieutenant. How does it look up on the cliff, Hardwick?"

"I suspect you know as well as I do," said Hardwick. "I think I saw a vision-camera planted up there."

"True enough. But there's nothing like on-the-spot inspection. Now you're back, how does it look to you?"

"Inadequate," said Hardwick with some dryness. "Inadequate to explain some things I've noticed. But it's a very bad situation. Its degree of badness depends on the viscosity of the mud at bedrock all over the island. The left-behind mud's like pea soup. It looks really bad! But what's the viscosity at bedrock with soil pressing down—and I hope drier soil than at the bottom?"

Sandringham grunted.

"Good question. I sent for you, Hardwick, when it began to look bad, before the ground really started sliding. When I thought it might begin any time. The viscosity averages pretty closely at three times ten to the sixth. Which still gives us some leeway. But not enough."

"Not nearly enough!" said Hardwick impatiently. "Irrigation should have been stopped a long while back!"

The Sector Chief grimaced.

"I've no authority over civilians. They've their own planetary government. And do you remember?" He quoted: "Civilian establishments and governments may be advised by Colonial Survey officials, and may make requests of them, but in each case such advice or request is to be considered on its own merits only, and in no case can it be the subject of a *quid-pro-quo* agreement." He added grimly: "That

means you can't threaten. It's been thrown at my head every time I've asked them to cut down their irrigation in the past fifteen years! I advised them not to irrigate at all, and they couldn't see it. It would increase the food-supply, and they needed more food. So they went ahead. They built two new sea-water freshening plants only last year!"

Werner licked his lips. He said in a voice that was higher-pitched than Hardwick remembered:

"What's happening serves them right! It serves them right!"

Hardwick waited.

"Now," said Sandringham, "they are demanding to be let into Sector Headquarters for safety. They say we haven't irrigated, so the ground we occupy isn't going to slide. They demand that we take them all in here to sit on their rumps until the rest of the island slides into the sea or doesn't. If it doesn't, they want to wait here until the soil becomes stable again because they've quit irrigating."

"It'd serve them right if we let them in!" cried Werner in shrill anger. "It's their fault that they're in this fix!"

Sandringham waved his hand.

"Administering abstract justice isn't my job. I imagine it's handled in more competent quarters. I have only to meet the objective situation. Which"—he paused—"is plenty! Hardwick, you've handled swamp-planet situations. What can be done to stop the sliding of the island's soil before it all goes overboard?"

"Not much, offhand," said Hardwick. "Give me time and I'll manage something. But a really bad storm, with high seas and plenty of rain, might wipe out the whole civilian colony. That viscosity figure is close to hopeless—if not quite."

The Sector Chief looked impassive.

"How much time does he have, Werner?"

"None!" said Werner shrilly. "The only possible thing is to try to move as many people as possible to the solid ground in the Arctic! The boats can be crowded—the situation demands it! And if the two space-craft in orbit are sent to collect a fleet, and as many people as possible are moved at once—there may be some survivors!"

Hardwick spread out his hands.

"I'm wondering," he observed, "what the really serious problem is. There's more than sliding soil the matter! Else you would... I'm sure Lieutenant Barnes has thought of this... let the civilian population into Headquarters to sit on its rump and wait for better times."

Sandringham glanced at young Barnes, who flushed hotly at being noticed.

"I'm sure you have good reasons, sir," he said embarrassedly.

"I have several," said the Sector Chief dryly. "For one thing, so long as we refuse to let them in, they're reassured. They can't imagine we'd let them down. But if we invited them in they'd panic and fight to get in first. There'd be a full-scale slaughter right there! They'd be sure disaster was only minutes off. Which it would be!"

He paused and glanced from one to the other of the senior officers.

"When I sent for you," he said wryly, "I meant for you, Hardwick, to take care of the possible sliding. I meant for Werner, here, to do the public-relations job of

scaring the civilians just enough to make them let it be done. It's not so simple, now!"

He drew a deep breath.

"It's pure chance that there is a Sector Headquarters. Or else it's Providence. We'll find that out later! But ten days ago it was discovered that an instrument had gone wrong over in the ship-fuel storage area. It didn't register when a tank leaked. And—a tank did leak. You know ship-fuel's harmless when it's refrigerated. You know what it's like when it's not. Dissolved in soil-moisture, it's not only catalyzed to explosive condition, but it's a hell of a corrosive, and it's eaten holes in some other tanks—and can you imagine trying to do anything about that?"

Hardwick felt a sensation of incredulous shock. Werner wrung his hands.

"If I could only find the man who made that faulty tank!" he said thickly. "He's killed all of us! All! Unless we get to solid ground in the Arctic!"

The Sector Chief said calmly:

"That's why I won't let them in, Hardwick. Our storage tanks go down to bedrock. The leaked fuel—warmed up, now—is seeping along bedrock and eating at other tanks, besides being absorbed generally by the soil and dissolving in the ground-water. We've pulled all personnel out of all the area it could have seeped down to."

Hardwick felt slightly cold at the back of his neck.

"I suspect," he said wryly, "that they came out on tiptoe, holding their breaths, and that they were careful not to drop anything or scrape their chairs when they got up to leave. I would have! Anything, of course, could set it off. But it is bound to go anyhow! Of course! Now I see why we couldn't make a rocket-landing!"

The chilly feeling seemed to spread as he realized more fully. When ship-fuel is refrigerated during its manufacture, it is about as safe a substance as can be imagined—so long as it is kept refrigerated. It is an energy-chemical compound, of atoms bound together with forced-valence linkages. But enormous amounts of energy are required to force valences upon reluctant atoms.

Illustration

When ship-fuel warms up, or is catalyzed, it goes on one step beyond the process of its manufacture. It goes on to the modification the refrigeration prevented. It changes its molecular configuration. What was stable because it was cold becomes something which is hysterically unstable because of its structure. The touch of a feather can detonate it. A shout can set it off.

It is, indeed, burned only molecule by molecule in a ship's engines, being catalyzed to the unstable state while cold at the very spot where it is to detonate. And since the energy yielded by detonation is that of the forced bonds... why... the energy-content of ship-fuel is much greater than a merely chemical compound can contain. Ship-fuel contains a measurable fraction of the power of atomic explosive. But it is much more practical for use on board ship.

The point now was, of course, that leaked into the ground and warmed... why... practically any vibratory motion will detonate it. Even dissolved, it can detonate because it is not a chemical but an energy-release action.

"A good, drumming, heavy rain," said Sandringham very calmly indeed, "which falls on this end of the island, will undoubtedly set off some scores of tons of leaked ship-fuel. And that ought to scatter and catalyze and detonate the rest. The explosion should be equivalent to at least a megaton fusion bomb." He paused, and added with irony, "Pretty situation, isn't it? If the civilians hadn't irrigated, we could evacuate Headquarters and let it blow—as it will anyhow. If the fuel hadn't leaked, we could let in the civilians until the island's soil decides what it's going to do. Either would be a nasty situation, but the combination—"

Werner said shrilly:

"Evacuation to the Arctic is the only possible answer! Some people can be saved! Some! I'll take a boat and equipment and go on ahead and get some sort of refuge ready."

There was dead silence. The brown dog, who had followed Hardwick from the outer terrace, now yawned loudly. Hardwick reached over and absent-mindedly scratched his ears. Young Barnes swallowed.

"Beg pardon, sir," he said awkwardly. "But what's the weather forecast?"

"Continued fair," said Sandringham pleasantly. "That's why I had Hardwick and Werner come down. Three heads are better than one. I've gambled their lives on their brains."

Hardwick continued thoughtfully to scratch the brown dog's ears. Werner licked his lips. Young Barnes looked from one to another of them. Then he looked back at the Sector Chief.

"Sir," he said awkwardly. "I... I think the odds are pretty good. Mr. Hardwick, sir—He'll manage!"

Then he flushed hotly at his own presumption in saying something consoling to a Sector Chief. It was comparable to telling him how to top off his vacuum-suit tanks.

But the Sector Chief nodded in grave approval and turned to Hardwick to hear what he had to say.

III

The leeward side of the island went very gently into the water. From a boat offshore—say, a couple of miles out—the shoreline looked low and flat and peaceful. There were houses in view, and there were boats afloat. But they were much smaller than those that had been towing a twenty-mile-long oil-slick out to sea. These boats did not ply back and forth. Most of them seemed anchored. On some of them there was activity. Men went overboard, without splashing, and things came up from the ocean bottom and were dumped inside their hulls, and then baskets went back down into the water. At long intervals—quite long intervals—men emerged from underwater and sat on the sides of the boats and smoked with an effect of leisure.

There was sunshine, and the land was green, and a seeming of vast tranquillity hung over the whole seascape. But the small Survey-personnel recreation-boat moved in toward the shore, and the look of things changed. At a mile, a mass of

green that had seemed to be trees growing down to the water's edge became a thicket of tumbled trunks and overset branches where a tree-thicket had collapsed. At half a mile the water was opaque. There were things floating in it—the roof of a house; the leaves of an ornamental shrub, with nearby its roots showing at the surface, washed clean. A child's toy bobbed past the boat. It looked horribly pathetic. There were the exotic planes and angles of three wooden steps, floating in the ripples of the great ocean.

"Ignoring the imminent explosion of the fuel store," said Hardwick dryly, "we need to find out something about what has to be done to the soil to stop its creeping. I hope you remembered, lieutenant, to ask a great many useless questions."

"Yes, sir," said Barnes. "I tried to, sir. I asked everything I could think of."

"Those boats yonder?"

Hardwick indicated a boat from which something like a wire basket splashed into the water as he gestured.

"A garden boat, sir," said Barnes. "On this side of the island the sea bottom slopes so gradually, sir, that there are sea gardens on the bottom. Shellfish from Earth do not thrive, sir, but there are edible sea plants. The gardeners cultivate them as on land, sir."

Hardwick reached overside and carefully took his twentieth sample of the sea water. He squinted, and estimated the distance to shore.

"I shall try to imagine someone wearing a diving mask and using a hoe," he said dryly. "What's the depth here?"

"We're half a mile out, sir," said Barnes promptly. "It should be about sixty feet, sir. The bottom seems to have about a three per cent grade, sir. That's the angle of repose of the mud. There's no sand to make a steeper slope possible."

"Three per cent's not bad!"

Hardwick looked pleased. He picked up one of his earlier samples and tilted it, checking the angle at which the sediment came to rest. The bottom mud, here, was essentially the same as the soil of the land. But the soil of the island was infinitely finely-divided. In fresh water it floated practically like a colloid. In sea water, obviously, it sank because of the salinity which made suspension difficult.

"You see the point, eh?" he asked. When Barnes shook his head, Hardwick explained, "Probably for my sins I've had a good deal to do with swamp planets. The mud of a salt swamp is quite different from a fresh-water swamp. The essential trouble with the people ashore is that by their irrigation they've contrived an island-wide swamp which happens to be upside down—the mud at the bottom. So the question is, can it acquire the properties of a salt swamp instead of a fresh-water swamp without killing all the vegetation on the surface? That's why I'm after these samples. As we go inshore the water should be fresher—on a shallowing shore like this with drainage in this direction."

He gestured to the Survey private at the stern of the boat.

"Closer in, please."

Barnes said:

"Sir, motorboats are forbidden inshore. The vibrations."

Hardwick shrugged.

"We will obey the rule. I've probably samples enough. How far out do the mudflats run—at the surface?"

"About two hundred yards at the surface, sir. The mud's about the consistency of thick cream. You can see where the ripples stop, sir."

Hardwick stared. He turned his eyes away.

"Er... sir," said Barnes unhappily. "May I ask, sir—"

Hardwick said dryly:

"You may. But the answer's pure theory. This information will do no good at all unless all the rest of the problem we face is solved. But solving the rest of the problem will do no good if this part remains unsolved. You see?"

"Yes, sir. But... the others seem more... urgent, sir."

Hardwick shrugged.

There was a shout from a nearby boat. Men were pointing ashore. Hardwick jerked his eyes to the shoreline.

A section of seemingly solid ground moved slowly toward the water. Its forefront seemed to disintegrate, and a singularly slow-moving swell moved out over the rippleless border of the sea, where mudbanks like thick cream reached the surface.

The moving mass was a good half-mile in width. Its outer edge dissolved in the sea, and the top tilted, and green vegetation leaned downwind and very deliberately subsided into the water. It was remarkably like the way an ingot of non-ferrous metal slides into the pool made by its own melting.

But the aftermath was somehow horrifying. When the tumbled soil was all dissolved—and the grass undulated like a floating meadow on the water—there remained a jagged shallow gap in the land-bank. There were irregularities: vertical striations and unevennesses in the exposed, broken soil.

Hardwick snatched up glasses and put them to his eyes. The shore seemed to leap toward him. He saw the harsh outlines of the temporary cliff go soft. The bottom ceased to look like soil. It glistened. It moved outward in masses which grew rounder as they swelled. They flowed after the now-vanished fallen stuff, into the water. The topsoil was suddenly undercut. The wetter material under it flowed away, leaving a ledge which bore carefully tended flowering shrubs—Hardwick could see specks of color which were their blossoms—and a brightly-colored, small trim house in which some family had lived.

Illustration

The flow-away of the deeper soil made a greater, more cavernous hollow beneath the surface. It began to collapse. The house teetered. It fell. It smashed. More soil dropped down, and more, and more.

Presently there was a depression, a sort of valley leading inland away from the sea, in what had been a rampart of green at the water's edge. It was still green, but through the glasses Hardwick could see that trees had fallen, and a white-painted fence was splintered. And there was still movement.

The movement slowed and slowed, but it was not possible to say when it stopped. In reality, it did not stop. The island's soil was still flowing into the ocean.

Barnes drew a deep breath.

"I... thought that was it, sir," he said shakily. "I mean... that the whole island would start sliding."

"The ground's a bit more water-soaked down here," Hardwick said briefly. "Inland the bottom-soil's not nearly as fluid as here. But I'd hate to have a really heavy rainfall right now!"

Barnes' mind jerked back to the Sector Chief's office.

"The drumming would set off the ship-fuel?"

"Among other things," said Hardwick. "Yes." Then he said abruptly: "How good are you at precision measurements? I've messed around on swamp planets. I know a bit too much about what I ought to find, which is not good for accuracy. Can you take these bottles and measure the rate of sedimentation and plot it against salinity?"

"Y-yes, sir. I'll try, sir."

"If we had soil-coagulants enough," said Hardwick vexedly, "we could handle that upside-down swamp the civilians have so carefully made, here. But we haven't got it! But the freshened sea water they've been irrigating with is practically mineral-free! I want to know how much mineral content in the water would keep the swamp-mud from acting like wet soap. It's entirely possible that we'd have to make the soil too salty to grow anything, in order to anchor it. But I want to know!"

Barnes said uncomfortably:

"Wouldn't you, sir... wouldn't you have to put the minerals in irrigation-water to get them down to the... the swamp?"

Hardwick grinned, very surprisingly.

"You've got promise, Barnes! Yes. I would. And it would increase the rate of slide before it stopped it. Which could be another problem. But it was good work to think of it! When we get back to Headquarters, you commandeer a laboratory and make those measurements for me."

"Yes, sir," said Barnes.

"We'll start back now," said Hardwick.

The recreation-boat obediently turned. It went out to sea until the water flowing past its hull was crystal-clear. And Hardwick seemed to relax. On the way they passed more small boats. Many of them were gardeners' boats, from which men dived with diving masks to tend or harvest the cultivated garden-patches not too far down. But many were pleasure boats, from double-hulled sailing craft intended purely for sport, to sturdy though small cabin cruisers which could venture far out to sea, or even around to the windward of the island for sport-fishing. All the pleasure craft were crowded—there were usually some children—and it was noticeable that on each one there were always some faces turned toward the shore.

"That," said Hardwick, "makes for emotional thinking. These people know their danger. So they've packed their children and their wives into these little cockleshells to try to save them. They're waiting offshore here to find out if they're doomed regardless. I wouldn't say"—he nodded toward a delicately designed twin-hull sailer with more children than adults aboard—"I wouldn't call that a good substitute for an Ark!"

Young Barnes fidgeted. The boat turned again and went parallel to the shore toward where Headquarters land came down to the sea. The ground was firmer, there. There had been no irrigation. Lateral seepage had done some damage at the edge of the reserve, but the major part of the shoreline was unbroken, unchanged solid ground, looming above the beach. There was, of course, no sand at the edge of the water. There had been no weathering of rock to produce it. When this island was upraised, its coating of hardened ooze protected the stone. The small lee-side waves merely lapped upon bare, curdled rock. The wharf for pleasure boats went out on metal pilings into deep water.

"Excuse me, sir," said young Barnes embarrassedly, "but... if the fuel blows, it'll be pretty bad, sir."

"That's the understatement of the century," Hardwick commented. "Yes. It will. Why?"

"You've something in mind, sir, to try to save the rest of the island. Nobody else seems to know what to do. If... if I may say so, sir, your... safety is pretty important. And you could do your work on the cliffs, sir, and... if I could stay at Headquarters and—"

He stopped, appalled at his own presumption in suggesting that he could substitute for a Senior Officer even as a message-boy, and even for his convenience or safety. He began to stammer:

"I m-mean, sir, n-not that I'm capable of it, sir—"

"Stop stammering," grunted Hardwick. "There aren't two separate problems. There's one which is the compound of the two. I'm staying at Headquarters to try something on the ship-fuel side, and Werner will specialize on the rest of the island since he hasn't come up with anything but shifting people to the ice pack. And the situation isn't hopeless! If there's an earthquake or a storm, of course we'll be wiped out. But short of one of those calamities, we can save part of the island. I don't know how much, but some. You make those measurements. If you're doubtful, get a Headquarters man to duplicate them. Then give me both sets."

"Y-yes, sir," said Young Barnes, miserably.

"And," said Hardwick formidably. "Never try to push your ranking officer into a safe place, even if you're willing to take his risk! Would you like it if a man under you tried to put you in a safe place while he took the chance that was yours?"

"N-no, sir!" admitted the very junior lieutenant. "But—"

"Make those measurements!" snapped Hardwick.

The boat came into the dock. Hardwick got out of the boat. He went to Sandringham's office.

Sandringham was in the act of listening to somebody in the phone-screen, who apparently was on the thin edge of hysteria. The brown dog was sprawled asleep on the rug.

When the man in the vision-screen panted to a stop, Sandringham said calmly:

"I am assured that before the soil of the island is too far gone, measures now in preparation will be applied to good effect. A Senior Survey Officer is now preparing remedial measures. He is a... ah... specialist in problems of exactly this nature."

"*But we can't wait!*" panted the civilian fiercely. "*I'll proclaim a planetary emergency! We'll take over the reserve area by force! We have to—*"

"If you try," Sandringham told him grimly, "I'll mount paralysis-guns to stop you!" He said with icy precision: "I urged the planetary government to go easy on this irrigation! You yourself denounced me in the Planetary Council for trying to interfere in civilian affairs! Now you want to interfere in Survey affairs! I resent it as much as you did, and with much better reason!"

"*Murderer!*" panted the civilian. "*Murderer!*"

Sandringham snapped off the phone-screen. He swung his chair and nodded to Hardwick.

"That was the planetary president," he said dryly.

Hardwick sat down. The brown dog blinked his eyes open and then got up and shook himself.

"I'm holding off those idiots!" said the Sector Chief in suppressed fury. "I daren't tell him it's more dangerous here than outside! If or when that fuel blows—Do you realize that the falling of a single tree limb might set off an explosion in the Reserve-area here that would—But you know."

"Yes," admitted Hardwick.

He did know. Even forty tons of ship-fuel going off would destroy this entire end of the island. It would be at least the equivalent of a megaton fusion bomb explosion. And almost certainly the concussion would produce violent movement of the rest of the island's surface. But he was uncomfortable about putting forward his own ideas. He was not a good salesman. He suspected his own opinions until he had proved them with extremely painstaking care—for fear of having them adopted on his past record rather than because they were sound. And then, too, his plan involved junior ranks being informed about the proposal. If they accepted a dubious plan on high authority, and the plan miscarried, it made them share in the mistake. Which hurt their self-confidence. Young Barnes, now, would undoubtedly obey any order and accept any hint blindly, and Hardwick honestly did not know why. But as a matter of the training of junior ranks—

"About the work to be done," said Hardwick. "I imagine the sea-water freshening plants have closed down?"

"They have!" said Sandringham curtly. "They insisted on piling them up over my protests. Now if anybody proposed operating one, they'd scream to high heaven!"

Hardwick felt uncomfortable.

"What was done with the minerals taken out of the sea water?"

"You know how the fresheners work!" said Sandringham. "They pump sea water in at one end, and at the other, one pipe yields fresh water, and another heavy brine. They dump the heavy brine back overboard and the fresh water's pumped up and distributed through the irrigation systems."

"It's too bad some of the salts weren't stored," said Hardwick. "Could a freshener be started up again?"

Sandringham said with irony:

"Oh, the civilians would love that! No! If any man started up a water-freshener, the civilians would kill him and smash it!"

"But I think we'll need one. We'll want to irrigate some ground up here."

"My God! What for?" demanded Sandringham. Then he said shortly: "No! Don't tell me! Let me try to work it out."

There was silence. The brown dog blinked at Hardwick. He held out his hand. The dog came sedately to him and bent his head to be scratched. Hardwick scratched.

After a considerable time, the Sector Chief growled:

"I give up. Do you want to tell me?"

Hardwick said painstakingly:

"In a sense, the trouble here is that there's a swamp underground, made by irrigation. It slides. It's really a swamp upside down. On Soris II we had a very odd problem, only the swamp was right-side-up there. We'd several hundred square miles of swamp that could be used if we could drain it. We built a soil-dam around it. You know the trick. You bore two rows of holes twenty feet apart, and put soil-coagulant in them. It's an old, old device. They used it a couple of hundred years ago back on Earth. The coagulant seeps out in all directions and... well... coagulates the dirt. Makes it water-tight. It swells with water and fills the space between the soil-particles. In a week or two there's a water-tight barrier, made of soil, going down to bedrock. You might call it a coffer-dam. No water can seep through. On Soris II we knew that if we could get the water out of the mud inside this coffer-dam, we'd have cultivable ground."

Sandringham said skeptically:

"But it called for ten years' pumping, eh? When mud doesn't move, pumping isn't easy!"

"We wanted the soil," said Hardwick. "And we didn't have ten years. The Soris II colony was supposed to relieve population-pressure on another planet. The pressure was terrific. We had to be ready to receive some colonists in eight months. We had to get the water out quicker than it could be pumped. And there was another problem mixed up with it. The swamp vegetation was pretty deadly. It had to be gotten rid of, too. So we made the dam and... well... took certain measures and then we irrigated it. With water from a nearby river. It was very ticklish. But we had dry ground in four months, with the swamp-vegetation killed and turning back to humus."

"I ought to read your reports," said Sandringham dourly. "I'm too busy, ordinarily. But I should read them. How'd you get rid of the water?"

Hardwick told him. He felt uncomfortable about it. The telling required eighteen words.

"Of course," he added, "we did pick a day when there was a strong wind from the right quarter."

Sandringham stared at him. Then he said vexedly:

"But how does that apply here? It was sound enough, though I'd never have thought of it. But what's it got to do with the situation here?"

"This... swamp, you might say," said Hardwick, "is underground. But there's forty feet, on an average, of soil on top."

He explained painstakingly what difference that made. It took him three sentences to make the difference clear.

Sandringham leaned back in his chair. Hardwick scratched the dog, somewhat embarrassed. Sandringham thought concentratedly.

"I do not see any possible chance," said Sandringham distastefully, "of doing it any other way. I would never have thought of that! But at least ninety per cent of

the people on this island, Civilian and Survey together, will die if we don't do something. So we will do this. But I'm taking it out of your hands, Hardwick."

Hardwick said nothing. He waited.

"Because," said Sandringham, "you're not the man to put over to the civilians what they must believe. You're not impressive. I know you, and I know you're a good man in a pinch. But this pinch needs a salesman. So I'm going to have Werner make the... er... pitch to the planetary government. Results are more important than justice, so Werner will front this affair."

Hardwick winced a little. But Sandringham was right. He didn't know how to be impressive. He could not speak with pompous conviction, which is so much more convincing than reason, to most people. He wasn't the man to get the co-operation of the non-Service population, because he could only explain what he knew and believed, and was not practiced in persuasion. But Werner was. He had the knack of making people believe anything, not because it was reasonable but because it was oratory.

"I suppose you're right," acknowledged Hardwick. "We need civilian help and a lot of it. I'm not the man to get it. He is." He did not say anything about Werner being the man to get credit, whether he deserved it or not. He patted the dog's head and stood up. "I wish I had a good supply of soil-coagulant. I need to make a coffer-dam in the reserve area here. But I think I'll manage."

Sandringham regarded him soberly as he moved to the door. As he was about to pass out of it, Sandringham said:

"Hardwick—"

"What?"

"Take good care of yourself. Will you?"

IV

Therefore Senior Officer Werner, of the Colonial Survey, received his instructions from Sandringham. Hardwick never knew the details of the instructions Werner got. They were possibly persuasive, or they may have been menacing. But Werner ceased to argue for the movement of any fraction of the island's population to the arctic ice cap, and instead made frequent eloquent addresses to the planetary population on the scientific means by which their lives were to be saved. Between the addresses, perhaps, he sweated cold sweat when a tree sedately tilted in what had seemed solid soil, or a building settled perceptibly while he looked at it, or when... say... a section of the island's soil bulged upward.

Publicly, he headed citizens' committees, and grandly gave instructions, and spoke in unintelligible and, therefore, extremely scientific terms when desperately earnest men asked for explanations. But he was perfectly clear in what he wanted them to do.

He wanted drill-holes in the arable soil down to the depth at which the holes began to close up of themselves. He wanted those holes not more than a hundred feet apart, in lines which slanted at forty-five degrees to the gradient of the bedrock.

Sandringham checked his speeches, at the rate of four a day. Once he had Hardwick called away from where he supervised extremely improbable operations. Hardwick was smeared with the island's grayish mud when he looked into the phone-plate to take the call.

"Hardwick," said Sandringham curtly, "Werner's saying those holes you want are to be lines at forty-five degrees to the gradient."

"That... I'd like a little more," said Hardwick. "A little less, rather. If they slanted three miles across the grade for every two downhill, it would be better. I'd like to put a lot more lines of holes. But there's the element of time."

"I'll have him explain that he was misquoted," said Sandringham, grimly. "Three across to two down. How close do you really want those lines?"

"It's not how close," said Hardwick. "I've got to have them quickly. How does the barometer look?"

"Down a tenth," said Sandringham.

Hardwick said:

"Damn! Has he got plenty of labor?"

"All the labor there is," said Sandringham. "And I'm having a road laid along the cliffs for speed with the trucks. If I dared... and if I had the pipe... I'd lay a pipe line."

"Later," said Hardwick tiredly. "If he's got labor to spare, set them to work turning the irrigation systems hind part before. Make them drainage systems. Use pumps. So if rain does come it won't be spread out on the land by all the pretty ditches. So it will be gathered instead and either flung back over the cliffs or else drained downhill without getting a chance to sink into the ground. For the time being, anyhow."

Sandringham said evenly:

"Has it occurred to you what a good, pounding rain would do to Headquarters, and consequently to public confidence on this island, and therefore to the attempt of anybody to do anything but wring his hands because he was doomed?"

Hardwick grimaced.

"I'm irrigating, here. I've got a small-sized lake made, and an ice coffer-dam, and the water-freshener is working around the clock. If there is labor, tell 'em to fix the irrigation systems into drainage layouts. That will cheer them, anyhow."

He was very weary, then. There is a certain exhausting quality in the need to tell other men to do work which may cause them to be killed spectacularly. The fact that one will certainly be killed with them does not lessen the tension.

He went back to his work. And it definitely seemed to be as purposeless as any man's work could possibly be. Down-grade from the now thoroughly deserted area in which ship-fuel tanks had leaked—quite far down-grade—he had commandeered all the refrigeration equipment in the warehouses. Since refrigeration was necessary for fuel-storage, there was a great deal. He had planted iron pipe in the soil, and circulated refrigerant in it, and presently there was a wall of solidly frozen earth which was shaped like a shallow U. It was a coffer-dam. In the curved part of that U he'd siphoned out a lake. A peristaltic pump ran sea water from the island's lee out upon the ground—where it instantly turned to mud—and another peristaltic pump sucked the mud up again and delivered it down-grade beyond the line of freezing-pipes. It was in fact a system of hydraulic

dredging such as is normally performed in rivers and harbors. But when topsoil is merely former abyssal mud it is an excellent way to move dirt. Also, it does not require anybody to strike blows into soil which may be explosive when one has gotten down near bedrock, and in particular there are no clanking machines.

But it was hair-raising.

In one day, though, he had a sizable lake pumped out. And he pumped it out to emptiness, painstakingly smelling the water as it went down to a greater depth below the previous ground surface. At the end of the day he shivered and ordered pumping ended for the time.

But then he had the brine-pipe laid around a great circuit, to the Headquarters ground which was upgrade from the now-deserted square mile or so in which the fuel tanks lay deep in the soil. And here, also, he performed excavation without the sound of hammer, shovel, or pick. He thrust pipes into the ground, and they had nozzles at the end which threw part of the water backward. So that when sea water poured into them it thrust them deeper into the ground by the backward jet action. Again the fact that the soil was abyssal mud made it possible. The nozzles floated up much grayish mud, but they bored ahead down to bedrock, and there they lay flat and tunneled to one side and the other—the tunnels they made being full of water at all times.

From those tunnels, as they extended, an astonishing amount of sea water seeped out into the soil near bedrock. But it was sea water. It was heavily mineralized. And it is a peculiarity of sea water that it is an electrolyte, and it is a property of electrolytes that they coagulate colloids, and rather definitely discourage the suspension of small solid particles which are on the borderline of being colloids. In fact, the water of the ocean of Canna III turned the ground-soil into good, honest mud which did not feel at all soapy, and through which it percolated with a surprising readiness.

Young Barnes eagerly supervised this part of the operation, once it was begun. He shamed the Survey personnel assigned to him into perhaps excessive self-confidence.

"He knows what he's doing," he said firmly. "Look here! I'll take that canteen. It's fresh water. Here's some soap. Wet it in fresh water and it lathers. See? It dissolves. Now try to dissolve it in sea water! Try it! See? They put salt in the boiled stuff to separate soap out, when they make it!" He'd picked up that item from Hardwick. "Sea water won't soften the ground. It can't! Come on, now, let's get another pipe putting more salt water underground!"

His workmen did not understand what he was doing, but they labored zestfully because it was mysterious and for a purpose. But downhill, in the hydraulic-dredged-out lake, water came seeping in, in the form of mud. And then another pipe came up from the seashore and the mud settled solidly on the bottom, not dispersing. It was a rather small pipe, and the personnel who laid it were bewildered. Because there was a water-freshening plant down there on the shore, and all the fresh water was poured back overboard, while the brine—saturated with salts from the ocean: unable to dissolve a single grain of anything else—was being used to fill the small artificial lake.

The second day Sandringham called Hardwick again, and again Hardwick peered wearily into the phone-screen.

"Yes," said Hardwick, "the leaked fuel is turning up. In solution, I'm trying to measure the concentration by matching specific gravities of lake water and brine, and then sticking electrodes in each. The fuel's corrosive as the devil. It gives a different EMF. Higher than brine of the same density. I think I've got it in hand."

"Do you want to start shipping it?" demanded Sandringham.

"You can begin pouring it down holes," said Hardwick. "How's the barometer?"

"Down three-tenths this morning. Steady now."

"Damn!" said Hardwick. "I'll set up molds. Freeze it in plastic bags the size of the bore-holes so it will go down. While it's frozen they can even push it down deep."

Sandringham said very grimly:

"There's been more damned technical work done with ship-fuel than any other substance since time began. But remember that the stuff can still be set off, even dissolved in water! Its sensitivity goes down, but it's not gone!"

"If it were," said Hardwick drearily, "you could invite in the civilian population to sit on its rump. I've got something like forty tons of ship-fuel in brine solution in this lake I pumped out! But it's in five thousand tons of brine. We don't speak above a whisper when we're around it. We walk in carpet slippers and you never saw people so polite! We will start freezing it."

"How can you handle it?" demanded Sandringham apprehensively.

"The brine freezes at minus thirty," said Hardwick. "In one per cent solution it's only five per cent sensitive at minus nineteen. We're handling it at minus nineteen. I think I'll step up the brine and chill it a little more."

He waved a mud-smear hand and went away.

That day, bolster-trucks began to roll out of Survey Headquarters. They rolled very, very smoothly, and they trailed a fog of chilled air behind them. And presently there were men with heavy gloves on their hands taking long things like sausages out of the bolster-trucks and untying the ends and lowering them down into holes bored in the topsoil until they reached places where wetness made the holes close up again. Then the men from Survey pushed those frozen sausages underground still further by long poles with carefully padded—and refrigerated—ends. And then they went on to other holes.

Illustration

The first day there were five hundred such sausages thrust down into holes in the ground, which holes to all intents and purposes closed up behind them. The second day there were four thousand. The third day there were eight. On the fourth the solution of ship-fuel in brine in the lake did not give adequate EMF in the little battery-cell designed to show how much corrosive substance there was in the brine. Hardwick took samples from the fluid draining into the lake. It was not mud any longer. Brine flowed at the top of bedrock, and it left the mud behind it, because salt water remarkably hindered the suspension of former globigerinous ooze particles. It was practically colloid. Salt water practically coagulated it.

The brine flowing from the salt-water tunnels upwind showed no more ship-fuel in it. Hardwick called Sandringham and told him.

"I can call in the civilians!" said Sandringham. "You've mopped up the leaked stuff! It couldn't have been done—"

"Not anywhere but here, with bedrock handy just underneath, and slanting," said Hardwick. "But I wouldn't advise it. Tell them they can come if they want to. They'll sort of drift in. I want to tap some more ship-fuel for the rest of those bore-holes. From the tanks that haven't leaked."

Sandringham hesitated.

"Twenty thousand holes," said Hardwick tiredly. "Each one had a six-hundred block of frozen saturated brine dumped in it, with roughly one pound of ship-fuel in solution. You have gone that far. Might as well go the rest of the way. How's the barometer?"

"Up a tenth," said Sandringham. "Still rising."

Hardwick blinked at him, because he had trouble keeping his eyes open now.

"Let's ride it, Sandringham!"

Sandringham hesitated. Then he said:

"Go ahead."

Hardwick waved his arms at his associates, whom he admired with great fervor in his then-foggy mind, because they were always ready to work when it was needed, and it had not stopped being needed for five days running. He explained very lucidly that there were only three more miles of holes to be filled up, and therefore they would just draw so much of ship-fuel and blend it carefully with an appropriate amount of suitable chilled brine and then freeze it in appropriate sausages—

Young Lieutenant Barnes said gravely:

"Yes, sir. I'll take care of it. You remember me, sir! I'll take care of it."

Hardwick said:

"Barometer's up a tenth." His eyes did not quite focus. "All right, lieutenant. Go ahead. Promising young officer. Excellent. I'll sit down here for just a moment."

When Barnes came back, Hardwick was asleep. And a last one hundred and fifty frozen sausages of brine and ship-fuel went out of Headquarters within a matter of hours, and then a vast quietude settled down everywhere.

Young Barnes sat beside Hardwick, menacing anybody who even thought of disturbing him. When Sandringham called for him. Barnes went to the phone-plate.

"Sir," he said with vast formality. "Mr. Hardwick went five days without sleep. His job's done. I won't wake him, sir!"

Sandringham raised his eyebrows.

"You won't?"

"I won't, sir!" said young Barnes.

Sandringham nodded.

"Fortunately," he observed, "nobody's listening. You are quite right."

He snapped the connection. And then young Barnes realized that he had defied a Sector Chief, which is something distinctly more improper in a junior officer than merely trying to instruct him in topping off his vacuum-suit tanks.

Twelve hours later, however, Sandringham called for him.

"Barometer's dropping, lieutenant. I'm concerned. I'm issuing a notice of the impending storm. Not everybody will crowd in on us, but a great many will. I'm explaining that the chemicals put into the bottom soil may not quite have finished their work. If Hardwick awakens, tell him."

"Yes, sir," said Barnes.

But he did not intend to wake Hardwick. Hardwick, however, woke of himself at the end of twenty hours of sleep. He was stiff and sore and his mouth tasted as if something had kitted in it. Fatigue can produce a hangover, too.

"How's the barometer?" he asked when his eyes came open.

"Dropping, sir. Heavy winds, sir. The Sector Chief has opened the Reserve Area, sir, to the civilians if they wish to come."

Hardwick computed dizzily on his fingers. A more complex instrument was actually needed, of course. One does not calculate on one's fingers just how long a one per cent solution of ship-fuel in frozen brine has taken to melt, and how completely it has diffused through an upside-down swamp with the pressure of forty feet of soil on top of it, and therefore its effective concentration and dispersal underground.

"I think," said Hardwick, "it's all right. By the way, did they turn the irrigation systems hind end to?"

Young Barnes did not know what this was all about. He had to send for information. Meanwhile he solicitously plied Hardwick with coffee and food. Hardwick grew reflective.

"Queer," he said. "You think of the damage forty tons of ship-fuel can do. Setting off the rest of the store and all. But even by itself it rates some thousands of tons of TNT. I wonder what TNT was, before it became a ton-measure of energy? You think of it exploding in one place, and it's appalling! But think of all that same amount of energy applied to square miles of upside-down swamp. Hundreds or thousands of miles of upside-down swamp. D'you know, lieutenant, on Soris II we pumped a ship-fuel solution onto a swamp we wanted to drain? Flooded it, and let it soak until a day came with a nice, strong, steady wind."

"Yes, sir," said Barnes respectfully.

"Then we detonated it. We didn't have a one per cent solution. It was more like a thousandth of one per cent solution. Nobody's ever measured the speed of propagation of an explosion in ship-fuel, dry. But it's been measured in dilute solution. It isn't the speed of sound. It's lower. It's purely a temperature-phenomenon. In water, at any dilution, ship-fuel goes off just barely below the boiling-point of water. It doesn't detonate from shock when it's diluted enough to be all ionized—but that takes a hell of a lot of dilution. Have you got some more coffee?"

"Yes, sir," said Barnes. "Coming up, sir."

"We floated ship-fuel solution over that swamp, Barnes, and let it stand. It has a high diffusion-rate. It went down into the mud—And there came a day when the wind was right. I dumped a red-hot iron bar into the swamp water that had ship-fuel in solution. It was the weirdest sight you ever saw!"

Barnes served him more coffee. And Hardwick sipped it, and it burned his tongue.

"It went up in steam," he said. "The swamp water that had the ship-fuel dissolved in it. It didn't explode, as a mass. They told me later that it propagated at hundreds of feet per second only. They could see the wall of steam go marching across the swamp. Not even high-pressure steam. There was a *whoosh!* and a cloud of steam half a mile high that the wind carried away. And all the surface

water in the swamp was gone, and all the swamp-vegetation parboiled and dead. So"—he yawned suddenly—"we had a ten-mile by fifty-mile stretch of arable ground ready for the coming colonists."

He tried the coffee again. He added reflectively:

"That trick—it didn't explode the ship-fuel, in a way. It burned it. In water. It applied the energy of the fuel to the boiling-away of water. Powerful stuff! We got rid of two feet of water on an average, counting what came out of the mud. It cost... hm-m-m... a fraction of a gram per square yard."

He gulped the coffee down. There were men looking at him solicitously. They seemed very glad to see him awake again. There was a monstrous bank of cloud-stuff piling up in the sky. He suddenly blinked at that.

"Hello! How long did I sleep, Barnes?"

Barnes told him. Hardwick shook his head to clear it.

"We'll go see Sandringham," said Hardwick, heavily. "I'd like to postpone firing as long as I can, short of having the stuff start draining into the sea to leeward."

There were mud-stained men around the place where Hardwick had slept. When he went—still groggy—out to the bolster-truck young Barnes had waiting, they regarded Hardwick in a very satisfying manner. Somebody grunted, "Good to've worked with you, sir,"—which is about as much of admiration as anybody would want to hear expressed. These associates of Hardwick in the mopping-up of leaked ship's fuel would be able to brag of the job at all times and in all places hereafter.

Then the truck went trundling away in search of Sandringham.

It found him on the cliffs to the windward side of the island. The sea was no longer a cerulean blue. It was slaty-color. There were occasional flecks of white foam on the water four thousand feet below. There were dark clouds, by then covering practically all the sky. Far out to sea, there were small craft heading grimly for the ends of the island, to go around it and ride out the coming storm in its lee.

Sandringham greeted Hardwick with relief. Werner stood close by, opening and closing his hands jerkily.

"Hardwick!" said the Sector Chief cordially. "We're having a disagreement, Werner and I. He's confident that the turning of the irrigation systems hind end to—making them surface-drainage systems, in effect—will take care of the whole situation. Adding the brine underground, he thinks, will have done a good deal more. He says it'll be bad, psychologically, for anything more to be done. He didn't speak of it, and it would injure public confidence in the Survey."

Hardwick said curtly:

"The only thing that will make a permanent difference on this island is for the water-fresheners to be a little less efficient. Barnes has the figures. He computed them from some measurements I had him make. If the water-freshener plants don't take all the sea-minerals out: if they don't make the irrigation-water so infernally soft and suitable for hair-washing and the like: if they turn out hard water for irrigation, this won't happen again! But there's too much water underground now. We have got to get it out, because a little more's going underground from this storm, surface-drainage systems or no surface-drainage systems."

Sandringham pointed to leeward, where a black, thick procession of human beings trooped toward the Survey area on foot and by every possible type of vehicle.

"I've ordered them turned into the ship-sheds and warehouses," said the Sector Chief. "But of course we haven't shelter for all of them. At a guess, when they feel safe they'll go back to their homes even through the storm."

The sky to windward grew blacker and blacker. There was no longer a steady flow of wind coming over the cliff's edge. It came in gusts, now, of extreme violence. They could make a man stagger on his feet. There were more flecks of white on the ocean's surface.

"The boats," added Sandringham, "were licked. There simply wasn't enough oil to maintain the slick. The radio reports were getting hysterical before I ordered them told that we had it beaten on shore. They're running for shelter now. I think they'd have stayed out there trying to hold the slick in place with their towline, if I hadn't said we had matters in hand."

Werner said, tight-lipped: "I hope we have!"

Hardwick shrugged.

"The wind's good and strong, now," he observed. "Let's find out. You've got the starting system all set?"

Sandringham waved his hand. There was a high-voltage battery set. It was of a type designed for blasting on airless planets, but that did not matter. Its cables led snakily for a couple of hundred feet to a very small pile of grayish soil which had been taken out of a bore-hole. They went over that untidy heap and down into the ground. Hardwick took hold of the firing-handle. He paused.

"How about highways?" he asked. "There might be some steam out of this hole."

"All allowed for," said Sandringham. "Go ahead."

There was a gust of wind strong enough to knock a man down. There was a humming sound in the air, as storm-wind beat upon the four-thousand-foot cliff and poured over its top. There were gradually rising waves, below. The sky was gray. The sea was slate-colored. Far, far to windward, the white line of pouring rain upon the water came marching toward the island.

Hardwick pumped the firing-handle.

There was a pause, while wind-gusts tore at his garments and staggered him where he stood. It was quite a long pause.

Then a white vapor came seeping out of the bore-hole. It was perfectly white. Then it came out with a sudden burst which was not in any sense explosive, but was merely a vast rushing of vaporized water. Then, a hundred yards away, there was a mistiness on the grassy surface. Still farther, a crack in the surface-soil let out a curtain of white vapor.

Here and there, everywhere, little gouts of steam poured into the air and tumbled in the storm-wind. It was notable that the steam did not come out as an invisible vapor, and condense in midair. It poured out of the ground in clouds, already condensed but thrust out by more masses of vapor behind it. It was not super-heated steam that came out. It was simply steam. Harmless steam, like the steam out of the spouts of tea kettles. But it rose from individual places everywhere. It made a massy coating of vapor which the storm-wind blew away. In seconds a half-mile of soil was venting steam; in seconds more a mile. The thick,

fleecy vapor swept across the landscape. The storm-wind could only tumble it and sweep it away.

In minutes there was no part of the island to be seen at all, save only the thin line of the cliffs reaching away between dark water on the one hand and snow-white clouds of vapor on the other.

"It can't scald anybody, can it?" asked Barnes uneasily.

"Not," said Hardwick, "when it's had to come up through forty feet of soil. It's been pretty well cooled off in taking up some extra moisture. It spread pretty well, didn't it?"

The Sector Chief's office had tall windows—doors, really—that looked out upon green lawn and many trees. Now a downpour of rain beat down outside. Wind whipped at the trees. There was tumult and roaring and the vibration of gusts of hurricane force. Even the building in which the Sector Chief's office was, vibrated slightly in the wind.

The Sector Chief beamed. The brown dog came in uneasily, looked around the room, and walked in leisurely fashion toward Hardwick. He settled with a sigh beside Hardwick's chair.

"What I want to know," said Werner tensely, "is, won't this rain put back all the water the ship-fuel boiled away?"

Hardwick said uncomfortably: "Two inches of rain would be a heavy fall, Sandringham tells me. It's the lack of heavy rains that made the civilians start irrigating. When you figure the energy-content of ship-fuel, Werner—an appreciable fraction of the energy in atomic explosive—it's sort of deceptive. Turn it into thermal units and it gets to be enlightening. We turned loose, underground, enough heat to boil away two feet of soil-water under the island's whole surface."

Werner said sharply:

"What'll happen when that heat passes up through the soil? It'll kill the vegetation, won't it?"

"No," said Hardwick mildly. "Because there *was* two feet of water to be turned to steam. The bottom layer of the soil was raised to the temperature of steam at a few pounds pressure. No more. The heat's already escaped. In the steam."

The phone-plate lighted. Sandringham snapped it on. A voice made a report in a highly official voice.

"Right!" said Sandringham. The highly official voice spoke again. "Right!" said Sandringham again. "You may tell the ships in orbit that they can come down now, if they don't mind getting wet." He turned. "Did you hear that, Hardwick? They have bored new cores. There are a few soggy spots, but the ground's as firm, all over the island, as it was when the Survey first came here. A very good job, Hardwick! A very good job!"

Hardwick flushed. He reached down and patted the head of the brown dog.

"Look!" said the Sector Chief. "My dog, there, has taken a liking to you. Will you accept him as a present, Hardwick?"

Hardwick grinned.

Young Barnes made ready to rejoin his ship. He was very strictly Service, very stiffly at attention. Hardwick shook hands with him.

"Nice to have had you around, lieutenant," he said warmly. "You're a very promising young officer. Sandringham knows it and has made a note of the fact."

Which I suspect is going to put you to a lot of trouble. There's a devilish shortage of promising young officers. He'll give you hellish jobs to do, because he has an idea you'll do them."

"I'll try, sir," said young Barnes formally. Then he said awkwardly, "May I say something, sir? I'm very proud, sir, to have worked with you. But dammit, sir, it seems to me that something more than just saying thank you was due you! The Service, sir, ought to—"

Hardwick regarded the young man approvingly.

"When I was your age," he said, "I'd the very same attitude. But I had the only reward the Service or anything else could give me. The job got done. It's the only reward you can expect in the Service, Barnes. You'll never get any other."

Young Barnes looked rebellious. He shook hands again.

"Besides," said Hardwick, "there is no better."

Young Barnes marched back toward his ship in the great metal crisscross of girders which was the landing-grid.

Hardwick absently patted his dog. He headed back toward Sandringham's office for his orders to return to his own work.

