CENTRAL INTELLIGENCE AGENCY DIRECTORATE OF INTELLIGENCE

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IRAQ'S L-29:

A Biological and Chemical Warfare Challenge to US Forces

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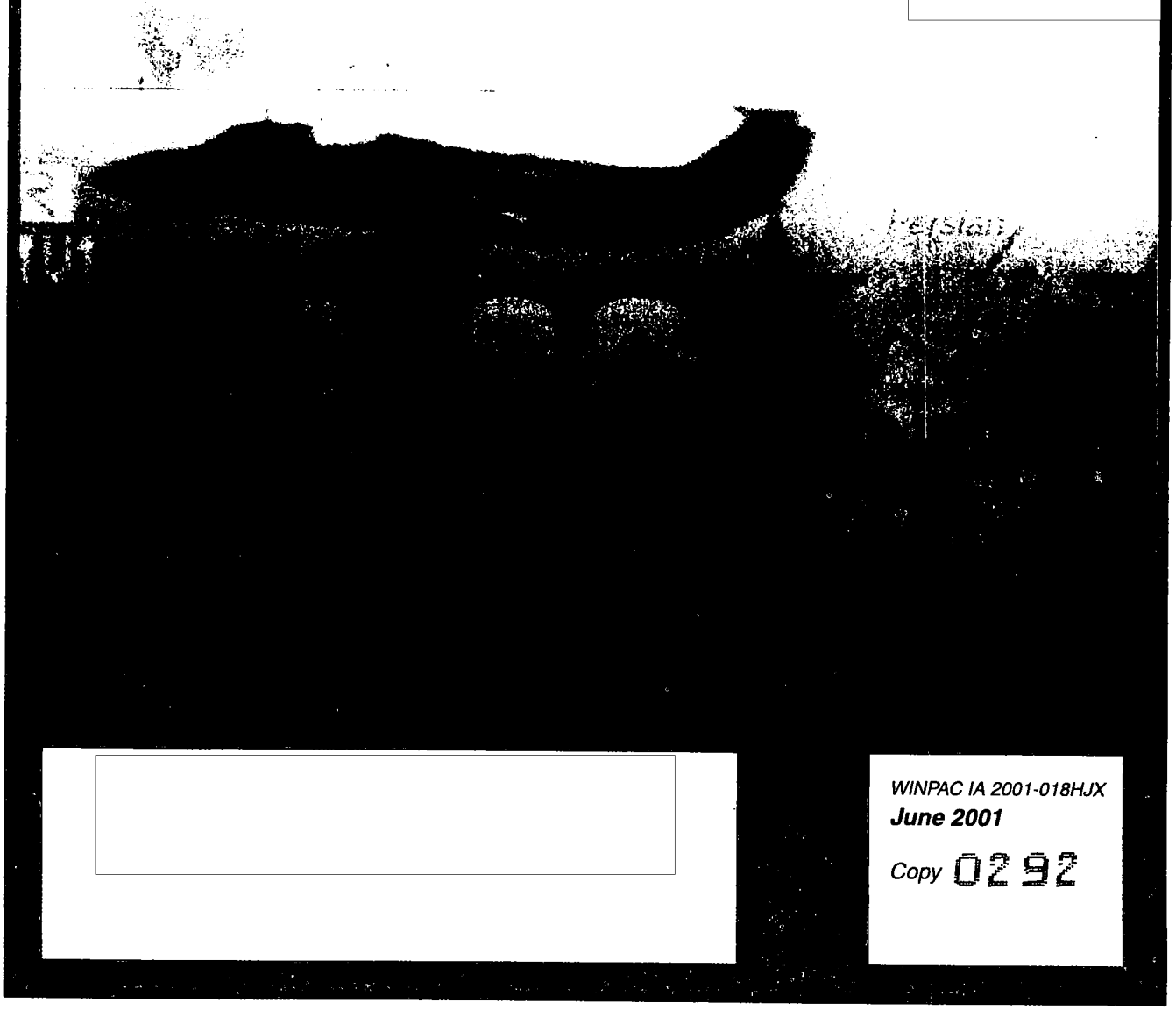

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WINPAC IA 2001-018HJX
June 2001
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Intelligence Assessment

DCI Center for Weapons Intelligence, Nonproliferation, and Arms Control

Iraq's L-29: A Biological and Chemical Warfare Challenge to US Forces [redacted] (b)(3)

This paper was prepared by analysts in the Weapons Intelligence, Nonproliferation, and Arms Control Center. Contributions were made by the Office of Near Eastern, South Asian, and African Analysis. Comments and queries are welcome and may be directed to [redacted] (b)(3)
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Iraq's L-29: A Biological and Chemical Warfare Challenge to US Forces (b)(3)

Key Findings (U)
Information available as of 1 November 2000 was used in this report. (U)

We assess that Iraq has converted 10 L-29s, out-of-production Czech jet trainers, to unmanned aerial vehicles (UAVs)—probably for delivery of biological warfare (BW) or, less likely, chemical warfare (CW) agents. Multiple sources indicate that the L-29 conversion program has been ongoing since 1995 and that Iraq is prepared to use the L-29 today as a UAV, although the crash of an L-29 UAV in October may have lessened the regime's confidence in the system (b)(3)

Analysis of reporting from multiple sensitive sources since 1998 points to a BCW delivery mission for the L-29.

- In early 1998, UNSCOM officials first learned of Iraqi efforts to convert the L-29 to a remotely piloted vehicle (RPV).

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The L-29 with a BW agent payload would most likely be launched from southeastern Iraq, threatening US forces and civilian targets in Kuwait, Saudi Arabia, and the northern Persian Gulf. (b)(1)

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- Should Iraqi leader Saddam Husayn perceive a threat to his regime's survival, we believe he would possibly use the L-29 to lash out at his enemies.

- We assess that the L-29 presents only a limited threat as a CW delivery vehicle and only if flown accurately to a target and carrying close to the assessed maximum payload. [redacted] (b)(3)

Multiple sources indicate that work continued on the L-29 through at least October 2000 and that Iraq may still be attempting to improve the capabilities of the system. Since the crash of an L-29 in October 2000, very little activity has been observed, suggesting that the program may be on hold while correction measures are taken. [redacted] (b)(1)

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- Iraq is possibly considering conversion of additional, more capable aircraft to UAVs for the same mission as the L-29; multiple sources suggest that Iraq may be considering conversion of the L-39 jet trainer for this purpose.

- It is possible that L-29 flight testing may also be related to other potential missions for the L-29; [redacted] (b)(1)

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Although we are confident in our assessment of the L-29 as a BCW delivery system, critical information gaps remain in our knowledge of its capabilities.

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- Although we have no information about the BCW agent delivery method for the L-29, we suspect the use of spray tanks derived from the aircraft's two external fuel tanks. Iraq is known to have done prior work to convert similar tanks for this purpose for an earlier program.

- We also do not know the amount of BCW agent that the L-29 would carry, but in-depth technical analyses suggest that it can carry a maximum payload of 500 kilograms.

- We do not know what type of BW or CW agent the L-29 is designed to carry [redacted] (b)(1) (b)(1) (b)(3)

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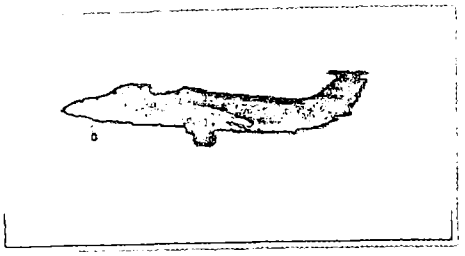
Contents

Appendix

Figure 1
Iraq: The L-29 "Delfin" Jet Trainer [redacted] (b)(3)



The L-29 "Delfin" is an out-of-production two-seat jet trainer aircraft produced in large numbers from 1961 to 1974 by the Czech company Aero Vodochody National Corporation. Iraq is believed to have acquired approximately 100 L-29s during the 1970s and 1980s, the majority of which either are now destroyed or are derelict and being cannibalized to provide spare parts for the few still capable of flight. [redacted] (b)(3)

The L-29 has tapered wings and a "T-tail" top-mounted horizontal stabilizer above the vertical stabilizer. The aircraft is equipped with a single Walter (Motorlet) M701 turbojet engine, an electrically controlled and hydraulically operated tricycle landing gear system, and mechanically operated primary flight controls. A hardpoint with associated pylon under each wing allows for carriage of either external fuel tanks or weapons. (U)

Specifications from the flight manual (except as noted)

Length:	**10.8 m**
Wingspan:	**10.3 m**
Height: *(top of horizontal stabilizer)*	**3.1 m**
Basic weight:	**2,195 kg**
Maximum takeoff gross weight (MTGW):	**3,550 kg**
Maximum internal fuel load:	**820 kg**
Design external payload capability: *(allows for 1.5 safety margin)*	**240 kg**
Maximum possible external payload capability (calculated): *(does not exceed MTGW; assumptions: full load of internal fuel, no aircrew, no additional equipment, benign flight profile)*	**535 kg**
Maximum allowable airspeed: *(with drop tanks, below 700 m)*	**820 km/h**
Maximum allowable mach: *(with drop tanks, above 700 m)*	**0.7 mach**
Takeoff Speed: *(15° flaps, MTGW)*	**176 km/h**
Takeoff Distance: *(15° flaps, MTGW, standard day, no wind)*	**780 m**
Stall speed: *(no flaps, gear retracted, 3,000-kg aircraft weight)*	**156 km/h**
Maximum aerodynamic range: *(internal fuel only, standard day conditions)*	**546-746 km**
Maximum Endurance: *(standard day, sea level, internal fuel only)*	**100 min**
Acceleration limitations:	**+7.5 Gs, -3.5 Gs**
Flight with asymmetrical external loads:	**Allowed** *(no restrictions)*

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Iraq's L-29: A Biological and Chemical Warfare Challenge to US Forces (b)(3)

Connection of the L-29 to a BCW Delivery Program

Reporting on post–Gulf war work by Iraq to develop a biological and chemical warfare (BCW) unmanned aerial vehicle (UAV) first came to light in 1997.

- Iraqi opposition press reports from July 1997 claimed that Iraq's Military Industrial Committee (MIC) had succeeded in converting the Polish M18 Dromader—a crop-spraying aircraft—into a "pilotless drone" for spraying BCW agents. This allegation was repeated in Western press in November 1997, most likely based on the previous press reporting. (b)(1) (b)(3)

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- By early 1998, UNSCOM officials became aware of Iraqi efforts to convert the Czech L-29 jet trainer to an RPV and inspected the airbase where the conversion was under way. UNSCOM inspectors visited sites associated with the L-29 project in July 1998 and the Al-Faris Drones Directorate in September 1998.

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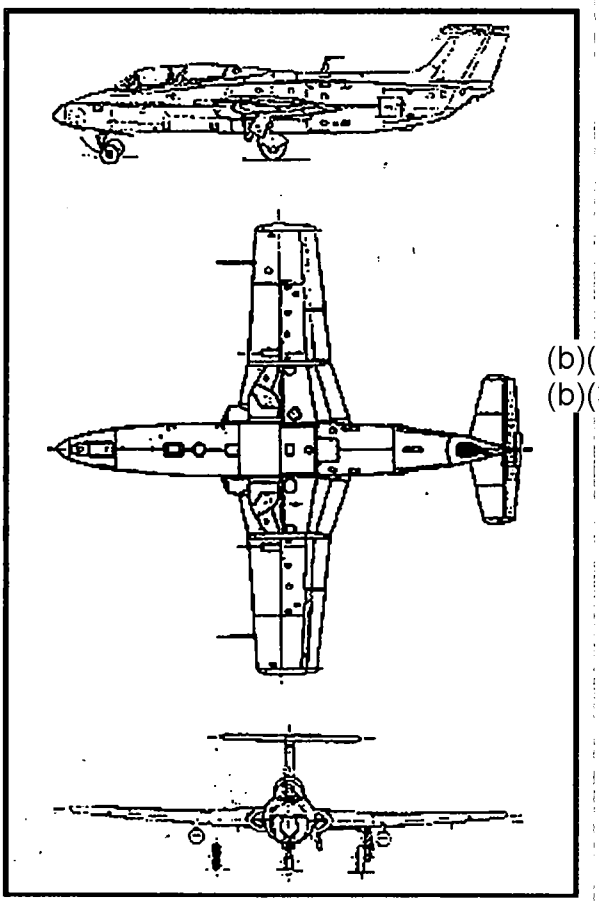
Figure 2
The L-29 Delfin Jet Trainer (b)(3)



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the Iraqis forward deployed the L-29 during a period of heightened tension with the United States. (b)(1)

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The L-29 is most likely a follow-on to Iraq's pre–Gulf war work on a MiG-21 RPV to deliver a BW payload as a line source via a spray tank, known as the Dhu-Al-Faqar project (see appendix).

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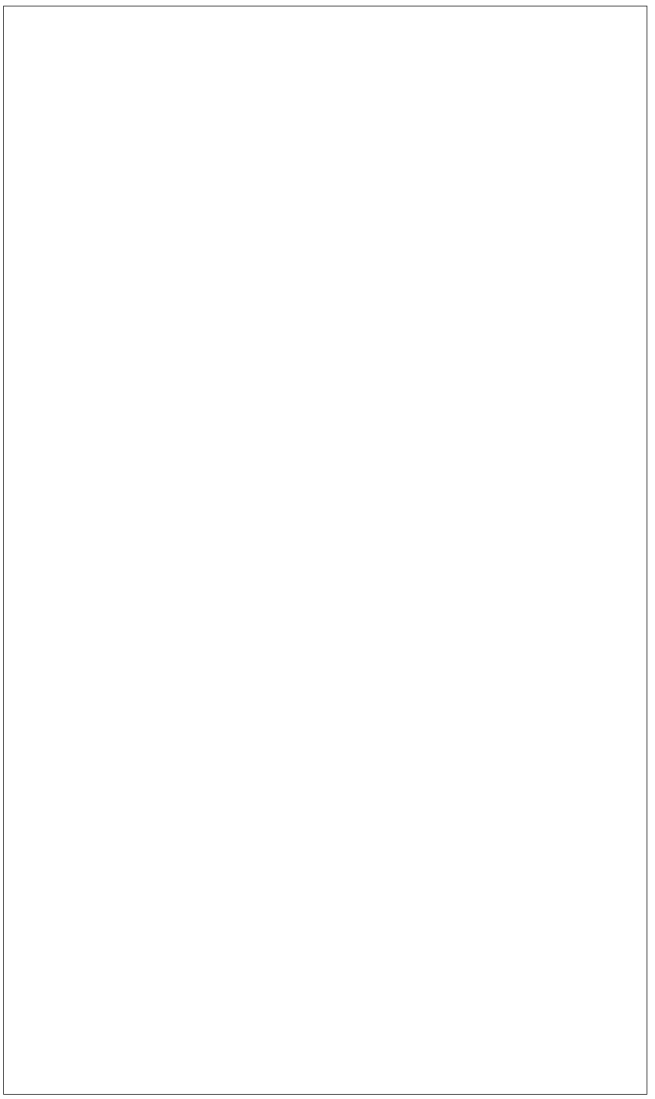

The L-29 is not as effective a delivery aircraft as the MiG-21—it is slower, which makes dissemination less efficient, and it cannot carry as large of a payload of BW or CW agent—but modeling of its potential coverage area shows that it could have a greater impact on military targets and cause a larger number of collateral civilian casualties than a conventionally armed aircraft. The L-29 would have a much greater impact on targets when carrying BW agent then when carrying CW agent.

Other Potential Missions of the L-29 UAVs (U)

Iraq may be considering other missions for the L-29 UAV. These other missions would be in addition to, not in lieu of, the primary role of BCW delivery and might include conventional weapons delivery, operation as an ELINT platform, and reconnaissance missions. (b)(1)

- (b)(1) (b)(3) the L-29 has conducted flight tests using conventional munitions but not with unconventional weapons. (b)(3) (b)(1)
- he L-29 RPVs have had communications monitoring and intercept equipment installed on them. With this equipment, Iraq is able to listen to allied aircraft communications traffic. This equipment relays the intercepted communications to the ground and reports the frequencies that allied aircraft are using for communications. (b)(3) the L-29 has not been used as a communications relay platform, although this is a planned mission.
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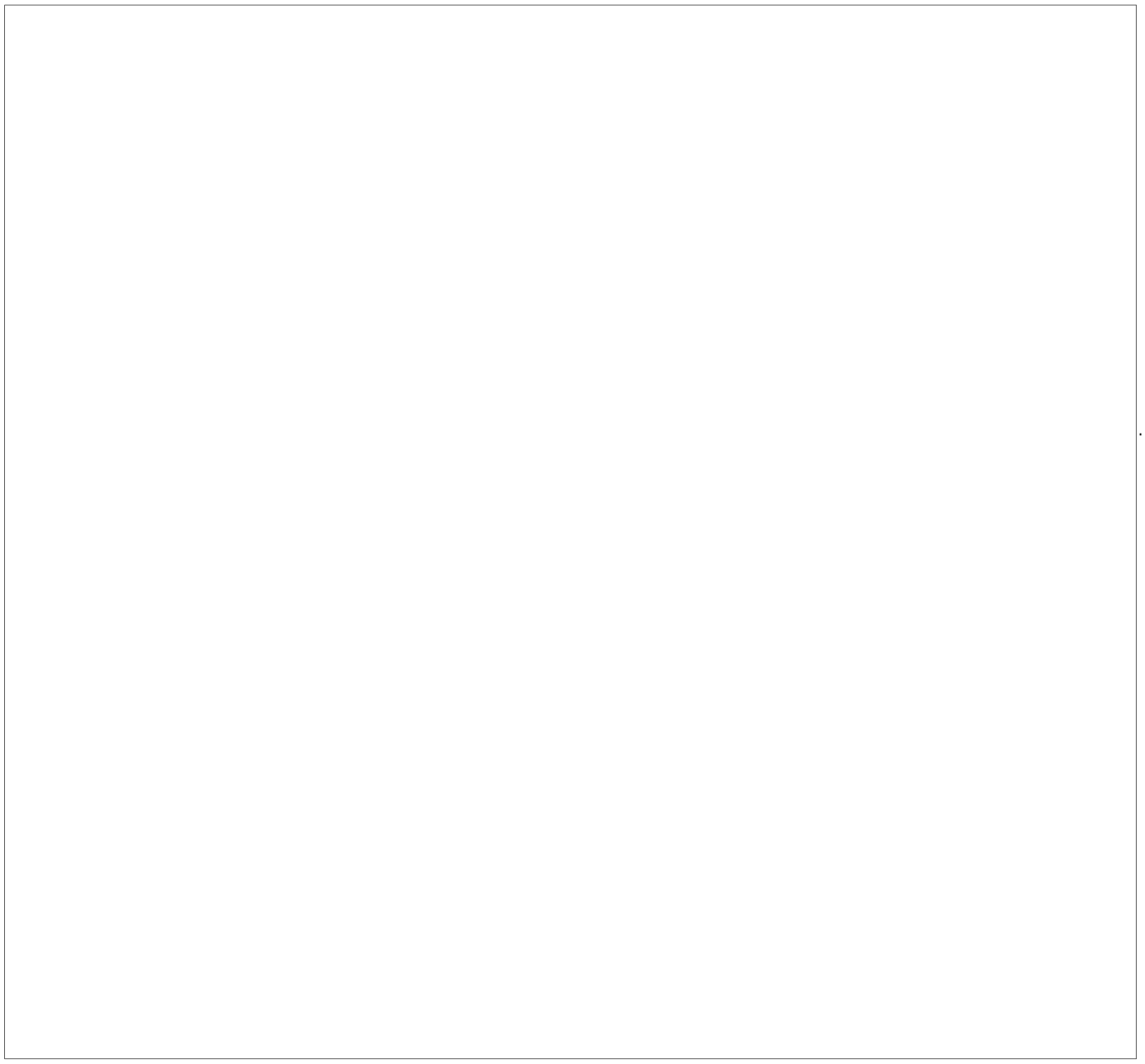
Operational Status of the L-29 UAVs (U)

Iraq was prepared (b)(3) to use the L-29 in an operational role as an RPV as early as November 1997. Although we assess that Iraq will remain prepared to employ the L-29 until the aircraft is replaced with a more capable system, a probable crash of an L-29 UAV in October 2000 will lessen the regime's confidence in the L-29 and might reduce the chances that it will be selected in the future for an operational mission. (b)(1) (b)(1)

- L-29 RPVs were deployed to Tallil Airbase in the southern no-fly zone in November 1997, (b)(3) (b)(1) (b)(3)



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Deployment of L-29s to the southern no-fly zone during a period of heightened tensions suggests that Iraq was prepared to use the system at that time.

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Having achieved a basic RPV capability for the L-29, a logical next step would be to upgrade the system by developing an autonomous flight capability. Continued flight-testing of the L-29 in July through at least December 1998 may therefore have been for the purpose of integration testing (b)(1) (b)(3)

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Regardless of intent, we judge the chances of successful operational employment of this system as varying from fair to good depending on operator currency and skill level, flight profile (that is, altitude, range, and speed), and control mode (that is, remote control or autopilot control). (b)(3)

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• Baghdad conducted "unmanned" flight tests on 13 April 1997, 1 June 1997, and 27 January 1998. (b)(3)

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Number of Converted L-29s (U))

Although the exact number and current disposition of these converted L-29s is unknown, a total of 10 were planned, with from four to six complete by 1998.

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Development of the L-29 UAV (U)

the L-29 program—officially called Al Bai'aa, which means "allegiance"—began at the urging of Saddam Husayn, who proposed the development of a cruise missile–like vehicle. Saddam entrusted his son Uday with executing the plan. Uday remained in charge until he was shot in an assassination attempt in 1996, at which time Gen. Muzahim Mus'ab Al-Tikriti, deputy director of MIC, took over management of the program.

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the existence of an Iraqi program to refurbish and convert L-29s to UAVs, with the work originally performed at the Aircraft Maintenance Center (AMC)—also known as the Aircraft Repair Factory—at Rasheed Airbase starting in 1993 and continuing there until at least mid-1996.

The L-29 UAV System (U)

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A complete L-29 UAV system is comprised of the L-29 air vehicle, an Italian manufactured Alamak GCS, and a directional video receiver antenna mounted on a boom truck. The boom truck is used to increase video downlink reception range, according to the Iraqis, but is not required for short-range operations. All system elements are highly mobile and can be moved and easily hidden on short notice, as was

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demonstrated in December 1998 prior to Operation Desert Fox.

Efforts To Upgrade the L-29 UAV System (U)

We assess that continued ground and flight activity associated with the L-29 UAV since early 1998 is associated with programs intended to upgrade the L-29, as well as with training of ground control operators and with "test flight" requirements for possible additional converted aircraft and for possible additional GCS units.

Range Extension Upgrade Programs

Status of Attempts To Develop an L-29 Autopilot. The L-29 autopilot upgrade programs are for the assessed purpose of increasing the range of the system to beyond the line-of-sight (LOS) range limit of approximately 125 km.

Definitions (U)

Autonomous flight. *The air vehicle operates independently of a remote operator.* (U)

OPV. *An optionally piloted vehicle is an aircraft that can be flown either manned or unmanned. In its unmanned mode, it might operate either autonomously (UAV) or under positive remote control (RPV).* (U)

RPV. *Remotely piloted vehicles are a subset of UAVs. An RPV is a UAV that can only be flown under positive remote control. Remote control can be from a GCS or another aircraft.* (U)

Semiautonomous system. *The air vehicle is launched and/or landed via remote control but thereafter operates autonomously.* (U)

UAV. *An unmanned, aerial vehicle is an unmanned, guided, air vehicle that is continuously self-propelled and sustains flight through the use of aerodynamic lift. This definition includes air vehicles capable of either or both autonomous guidance, and man-in-the loop (RPV) control.* (U)

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By November 1998, the autopilot was successfully used in two unmanned test flights—on 1 March 1998 and 1 May 1998.

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Possible Efforts To Develop an OTH Link. Evidence exists that Iraq is interested in developing an OTH link for the L-29, almost certainly to mitigate the current L-29 LOS control range limitations.

- Iraq declared in its BW program "Full, Final and Complete Declaration" (FFCD) that it had explored the concept of MiG-21 RPV remote control from a second aircraft and that it had flight-tested the MiG-21 RPV in January 1991. Remote control by a second aircraft would extend the LOS range of the L-29.

- (b)(1)(3) Iraq is studying the idea of using relay aircraft to increase the control range of the L-29 from the GCS. (b)(3)

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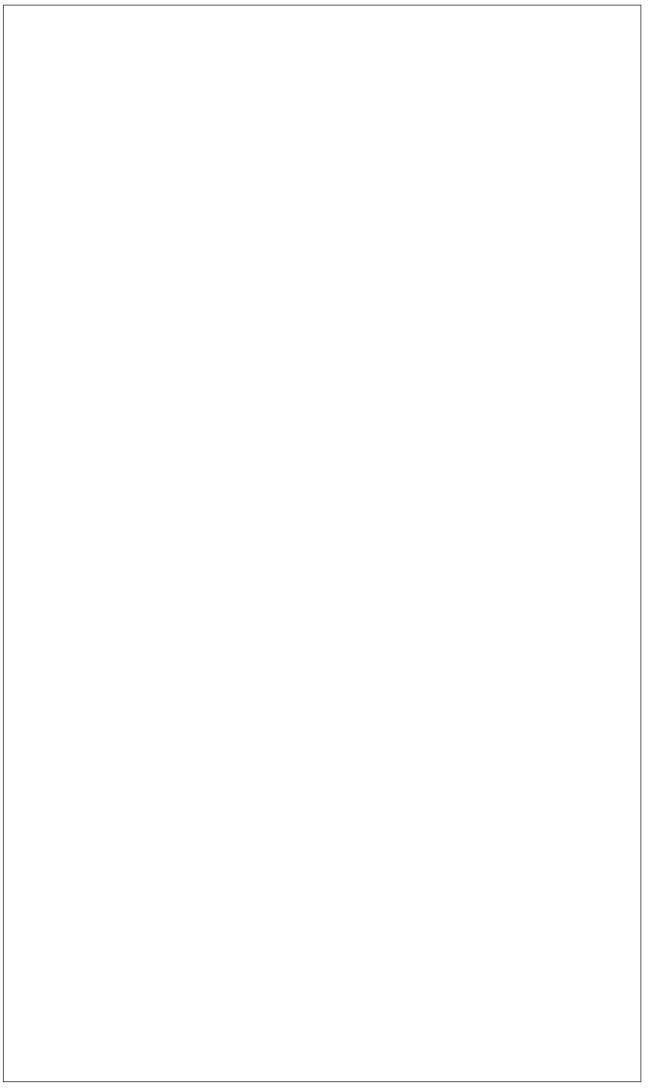

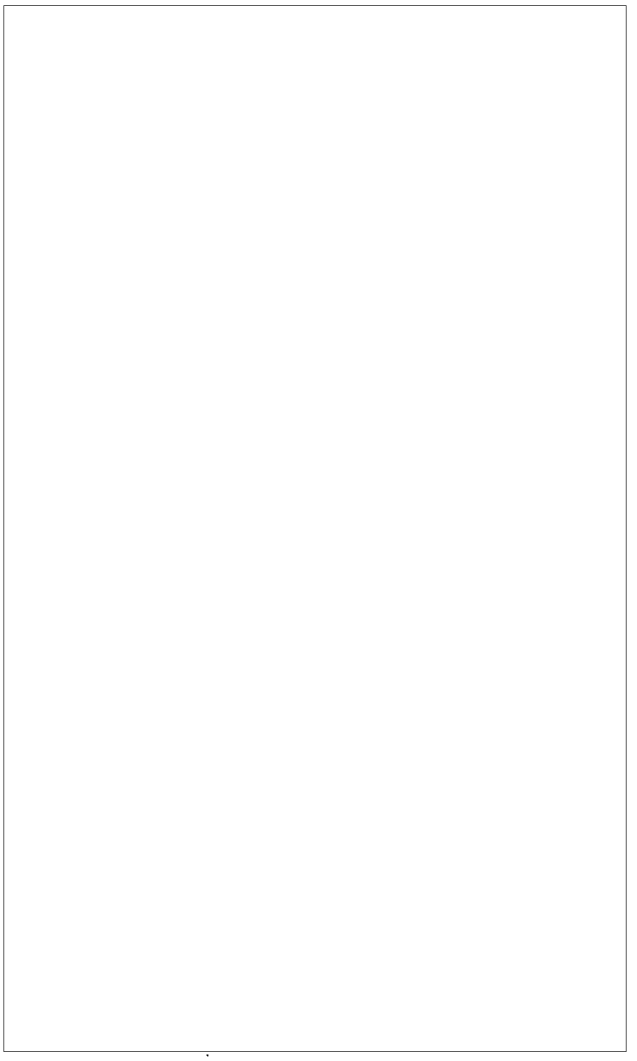

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Other L-29 Flight Activities (U)

L-29 flight activity could be the result of numerous other requirements. It is possible that new remote operators are being trained, and it would be necessary to maintain the proficiency of existing operators. At least one acceptance "test flight," and possibly more than one, would be required to confirm the functionality of newly converted L-29 air vehicles and to test the operational status of a possible new GCS. In addition, it is probable that the Iraqis would flight-test a BCW delivery system, once developed, on the L-29. All of these other activities might already have occurred but have not been identified as such.

Operational Employment of the L-29 UAV With a BCW Payload

The L-29 with a CW, or more likely, BW agent payload could be used to threaten civilian and military facilities in Kuwait, Saudi Arabia, and Iran, as well as US naval forces in the northern Persian Gulf. Israel is considered a less likely target because of L-29 range limitations and intervening terrain; also it is unlikely that either Syria or Jordan would knowingly permit overflight of an L-29 carrying BCW agents to strike Israel.

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Saddam would most likely use unmanned aircraft delivering BCW agents to lash out at his enemies—including deployed US military forces—should he perceive a threat to his regime's survival. Although use of such a system as anything other than a weapon of last resort would carry extreme risk for Baghdad

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during a period when it claims to no longer possess weapons of mass destruction. Over the longer term, Saddam most likely perceives this system as part of a strategic deterrent against future US military intervention.

the L-29 flight manual states that the aircraft can carry a maximum payload of 240 kg—the approximate mass of the two wing tanks when filled with 300 liters of fuel. Analysis based on L-29 airframe information from the L-29 flight manual leads to our assessment that the aircraft could carry as much as 500 kg of payload—250 kg on each hardpoint—

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- The L-29 has a poor flightpath accuracy without a precise guidance, navigation, and control system installed—ruling out precision delivery of conventional bombs or crashing the aircraft on a target.

- The relative ease with which an L-29 can be detected and engaged suggests that it must be used in a standoff attack to be survivable, an option available only with spray tanks if BW is used.

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The L-29 is most suitable as a delivery system for BW rather than CW because of its relatively small payload, lack of precision targeting, and vulnerability to air defenses. An L-29 carrying CW agent could be an effective weapon only if:

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- The aircraft carries 430 kg—the assessed maximum payload—of CW agent.

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- The aircraft impacts on the target with its CW agent payload rather than spray the agent upwind of the target, that is, functions as a point-source delivery system rather than a line-source delivery system.

- A precise navigation and guidance system is integrated into the flight control system, improving the chances of accurately striking the intended target.

- The L-29 is used to attack an undefended or unsuspecting target.

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An L-29 delivering a payload of 430 kg of CW agent would at most contaminate several hundred square meters at the target.

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The L-29 would most likely be launched from a prepared field in southeastern Iraq, placing the launchsite and GCS in proximity to likely targets in Kuwait, Saudi Arabia, and the northern Gulf.

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It is possible that the L-29 could be launched by a GCS at one location (well away from the border or coast) and then handed off to a second, forward deployed GCS. Although testing of this capability has not been observed, US UAV operators note that this is not a difficult procedure as long as a reliable communication link exists between the two GCSs.

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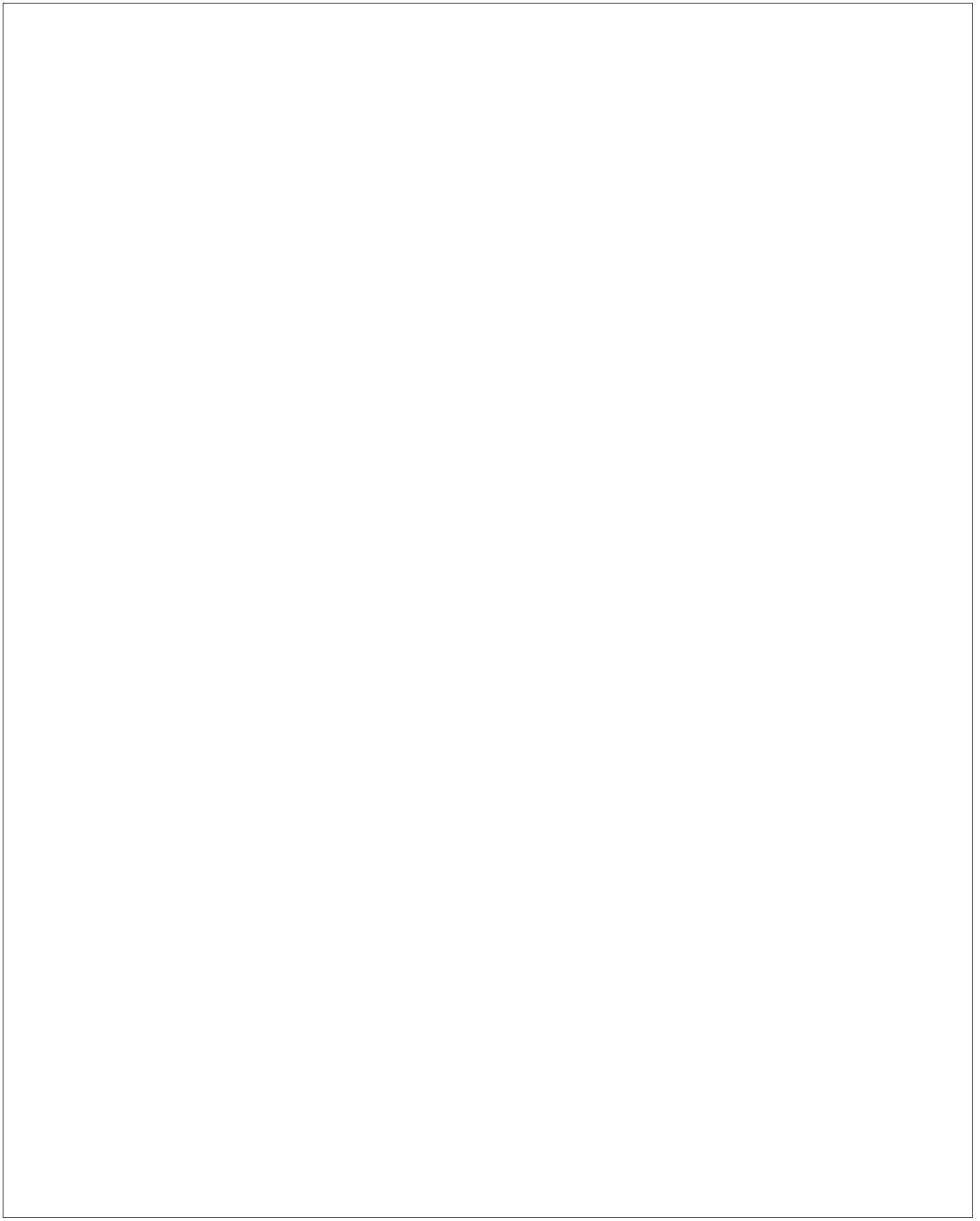

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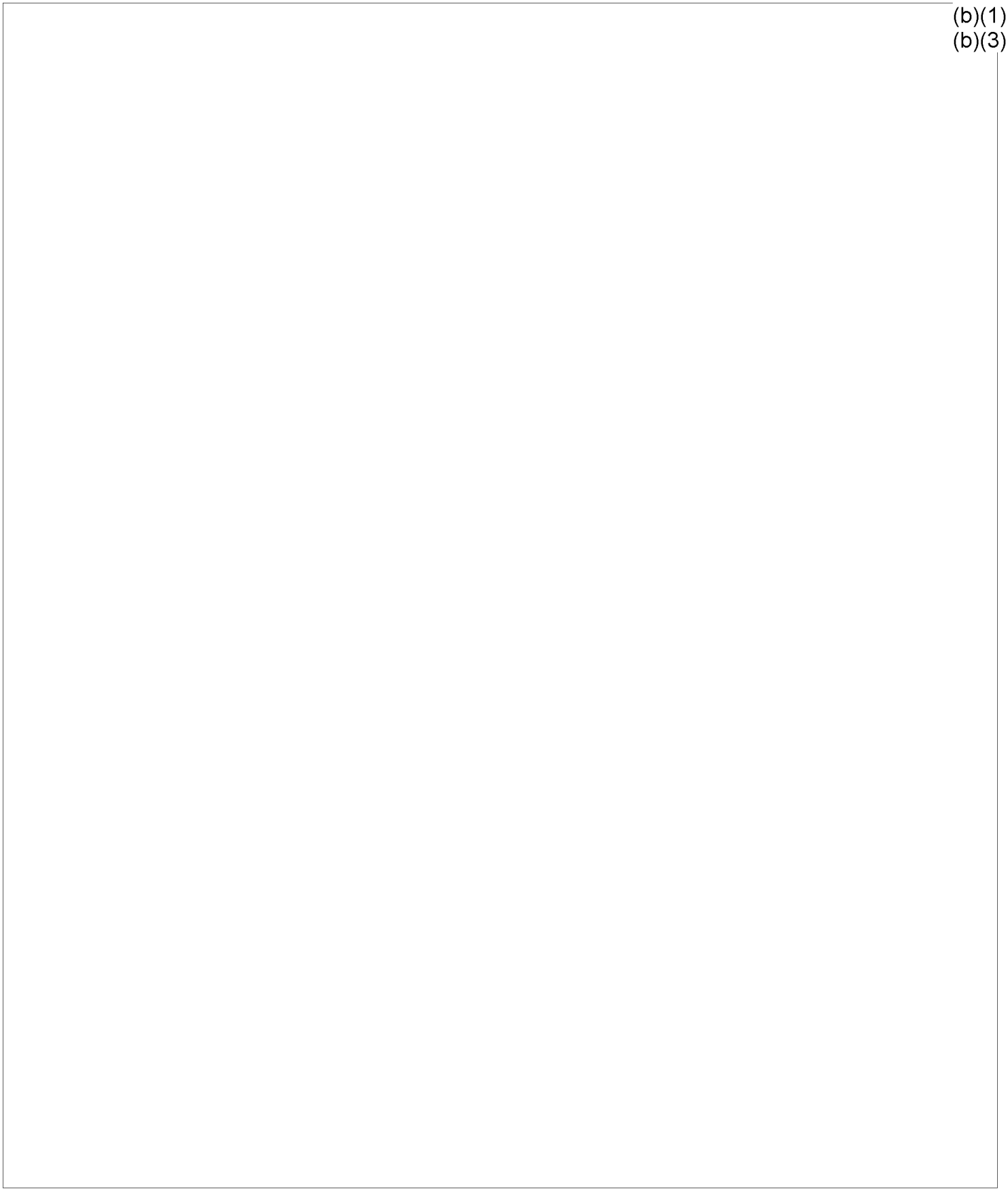

Figure 8
Iraqi L-29 Unmanned Aircraft Likely Deployment Area and Potential Ranges (b)(3)

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(b)(1) the Iraqis may have reconsidered their initial decision not to use L-39s or MiGs.
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The L-39 has three times the payload and twice the speed and range capability of the L-29, and pilot training using the aircraft takes place at Al Sahra Airbase, a site already directly associated with the L-29 project. In addition, (b)(3)
Iraq may have at least considered employing crop-dusters (either manned or unmanned) as BCW delivery platforms. (b)(3)
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If Iraq is pursuing conversion of additional aircraft to UAVs, then it is possible that the continued L-29 ground and flight activity observed at Samarra East Airbase could be intended to deceive and distract US collection resources from this additional covert program. (b)(3)

Possibility of Deception in the L-29 Program

It is possible that some of the activity that the US Intelligence Community has observed related to the L-29 program is part of a deception campaign. A deception campaign would focus intelligence attention on certain aspects of the project, serving the purpose of denying access to other aspects or alternatives to the program. (b)(1)

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Is L-29 All There Is to This Program? (U)

Why Would Iraq Want To Pass Information About the L-29?

Iraq is aware that the international community, and the United States in particular, is very concerned about Iraqi weapons development programs, especially in (b)(3)

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the area of WMD. The Iraqis are aware that the L-29 program has been compromised to the West.

- In July 1998, UNSCOM conducted an inspection mission to examine L-29–related sites.
- US forces bombed L-29–related sites during operation Desert Fox in late 1998.

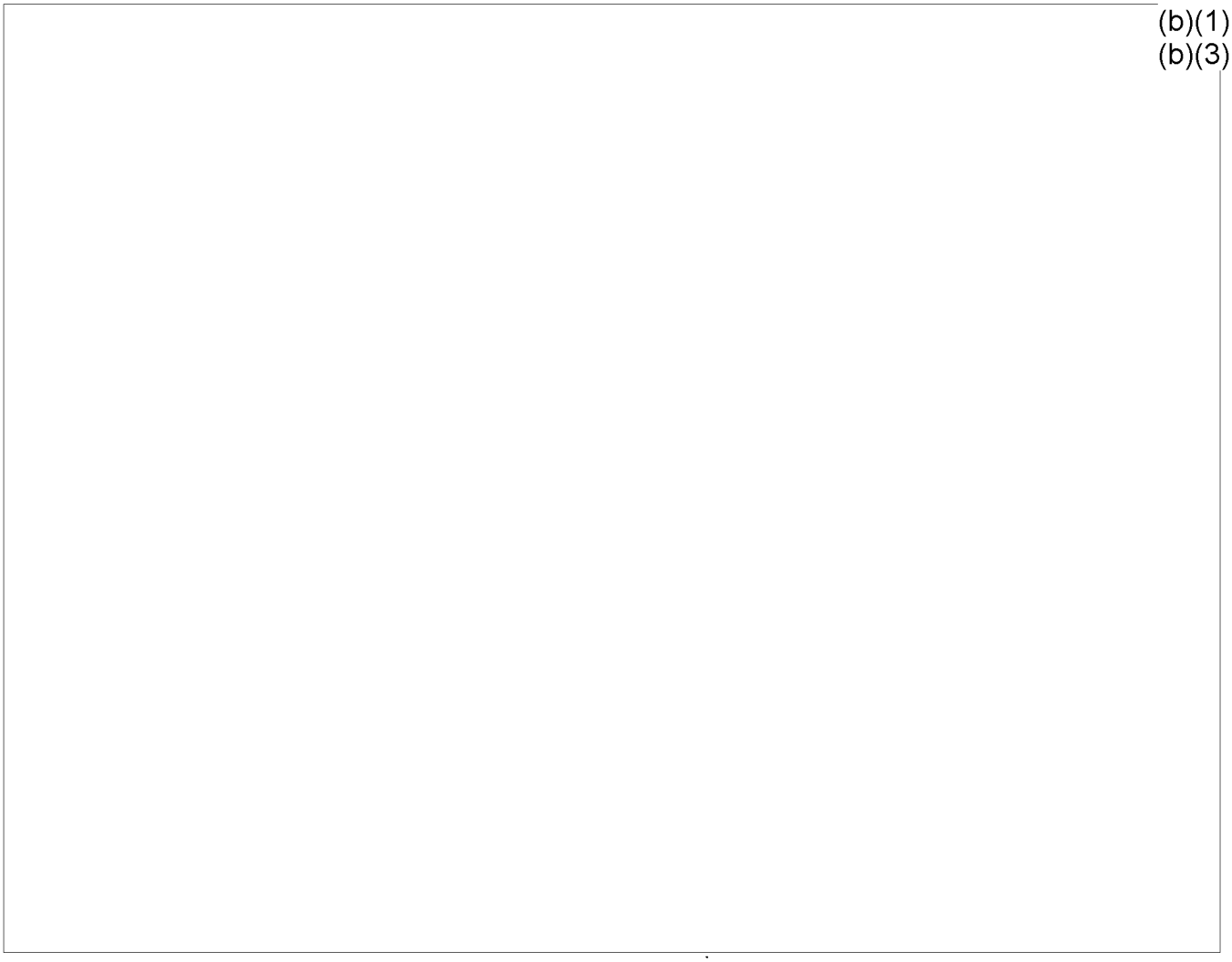
- The L-29 program was reported in the German press and on a US television news program in early 1998.

Iraq, realizing that the West knows about this program, may want to keep foreign attention focused on this project, while another more advanced successor program is developed and hidden from foreign intelligence services. The Iraqis may be directing attention to the
L-29 program in the belief that if foreign intelligence collectors can see an active program, they will be far less likely to search for a successor program. It is also possible that the continued ground and flight activity at Samarra East Airbase could be intended to mask another covert L-29–related site.

What Is the Successor Program?
Information could be directed at Western intelligence agencies to mask some other activity or program. Probable options include:

- Other L-29 testing, training, or deployment sites.
- Conversion of other aircraft into UAVs; the L-39 and MiG-21 are considered potential candidates.
- Development of a different BW delivery system.

The L-29 program most likely remains an active program, capable of being used by Iraq in an operational capacity. However, if Iraq is working on a successor program, it is possible that Iraq would be willing to use the L-29 as a bargaining chip to appear cooperative with international arms inspection regimes in order to achieve the lifting of sanctions. A likely scenario would be that Iraq would "reveal" the L-29 program to the UN Monitoring, Verification, and Inspection Commission, the entity which has replaced UNSCOM, and then offer to give it up in a show of good faith and cooperation.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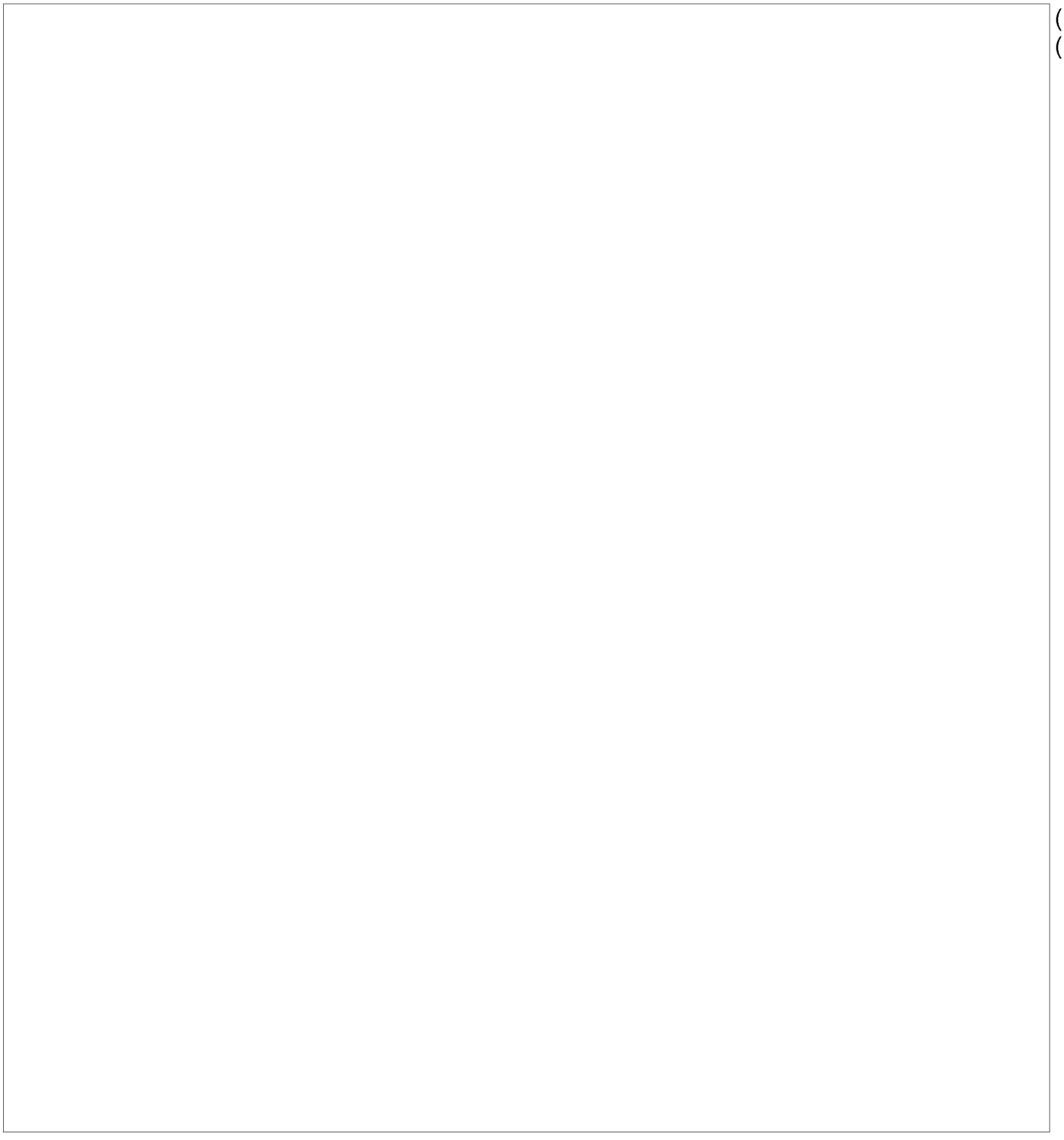
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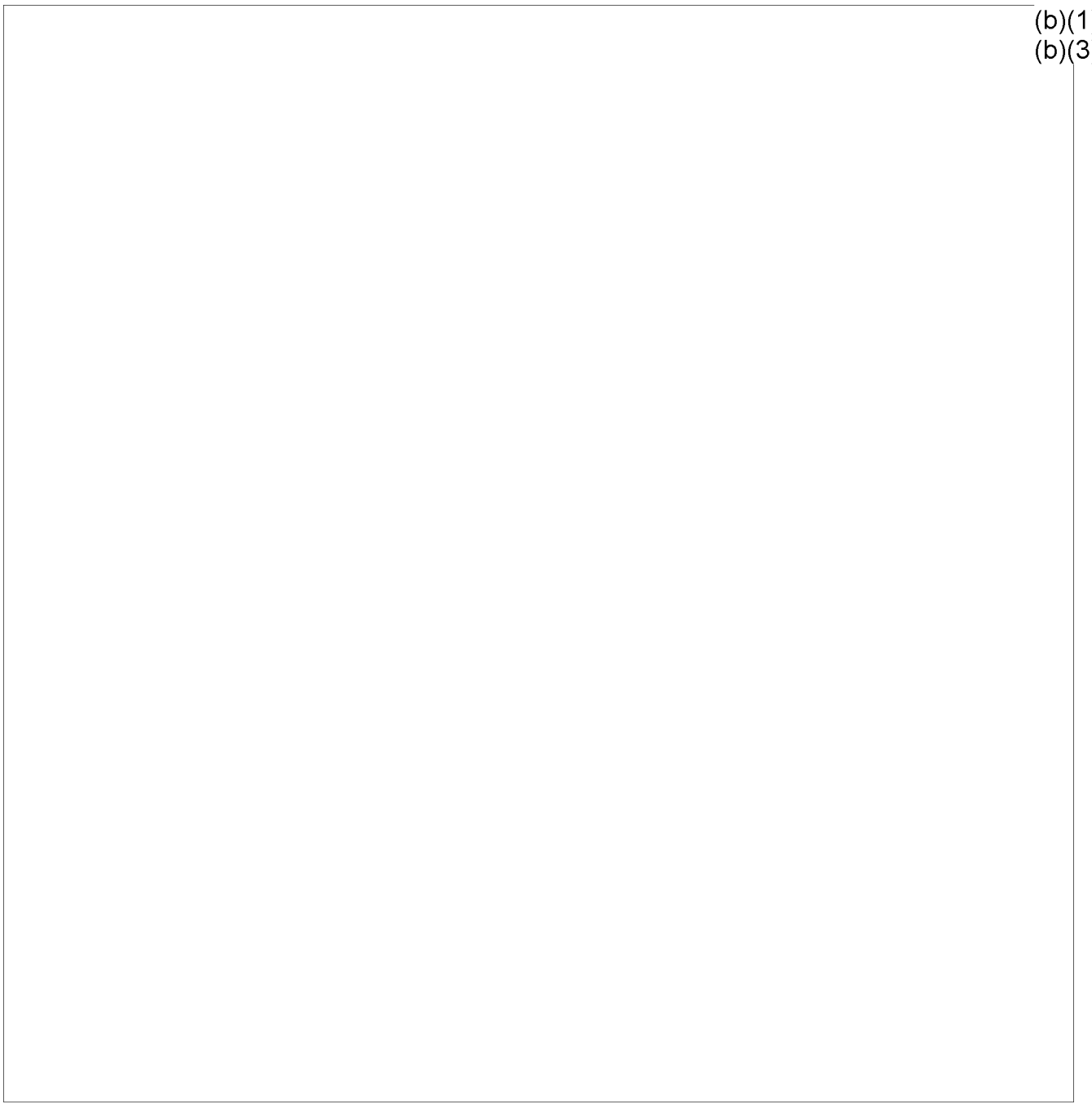

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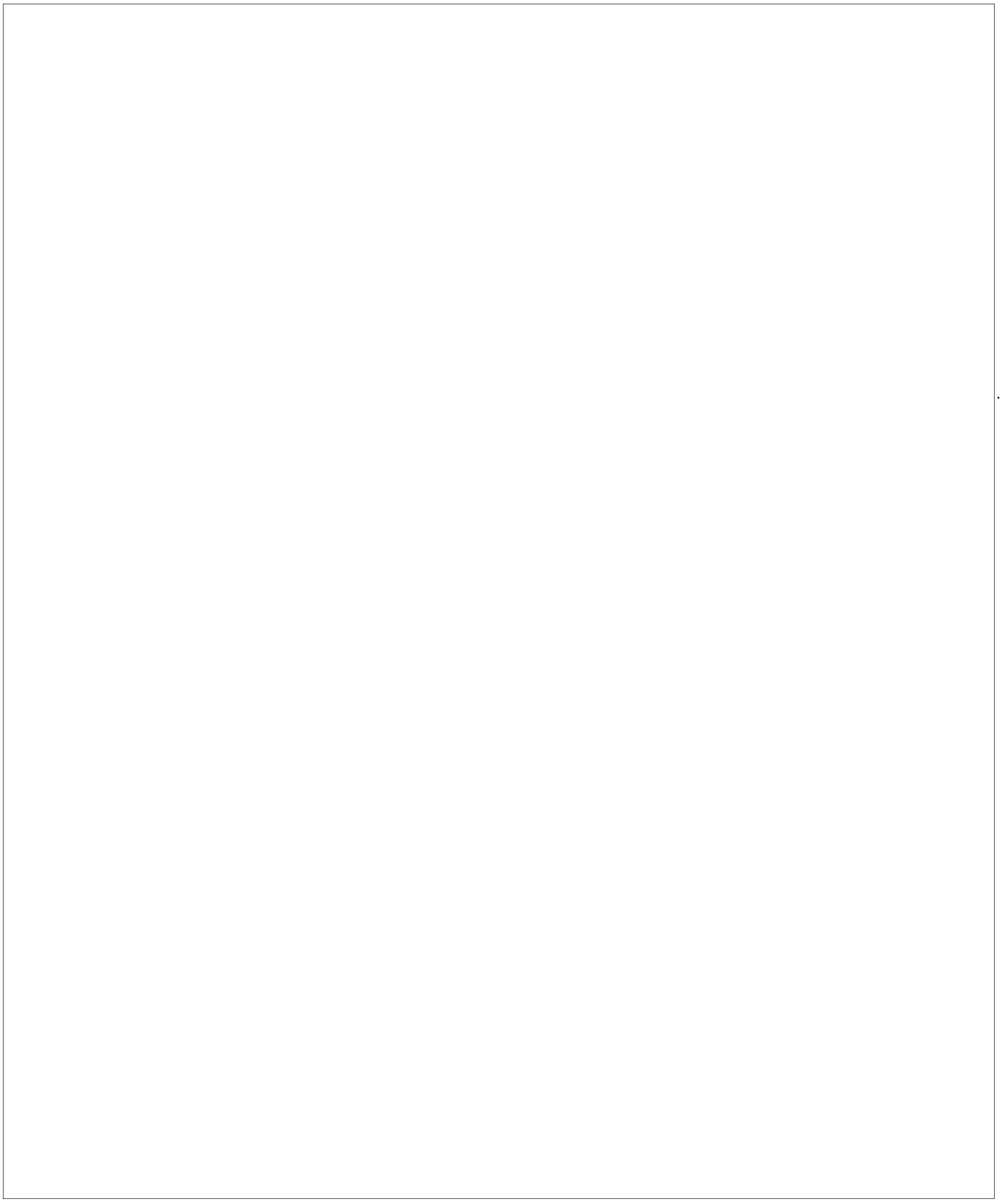

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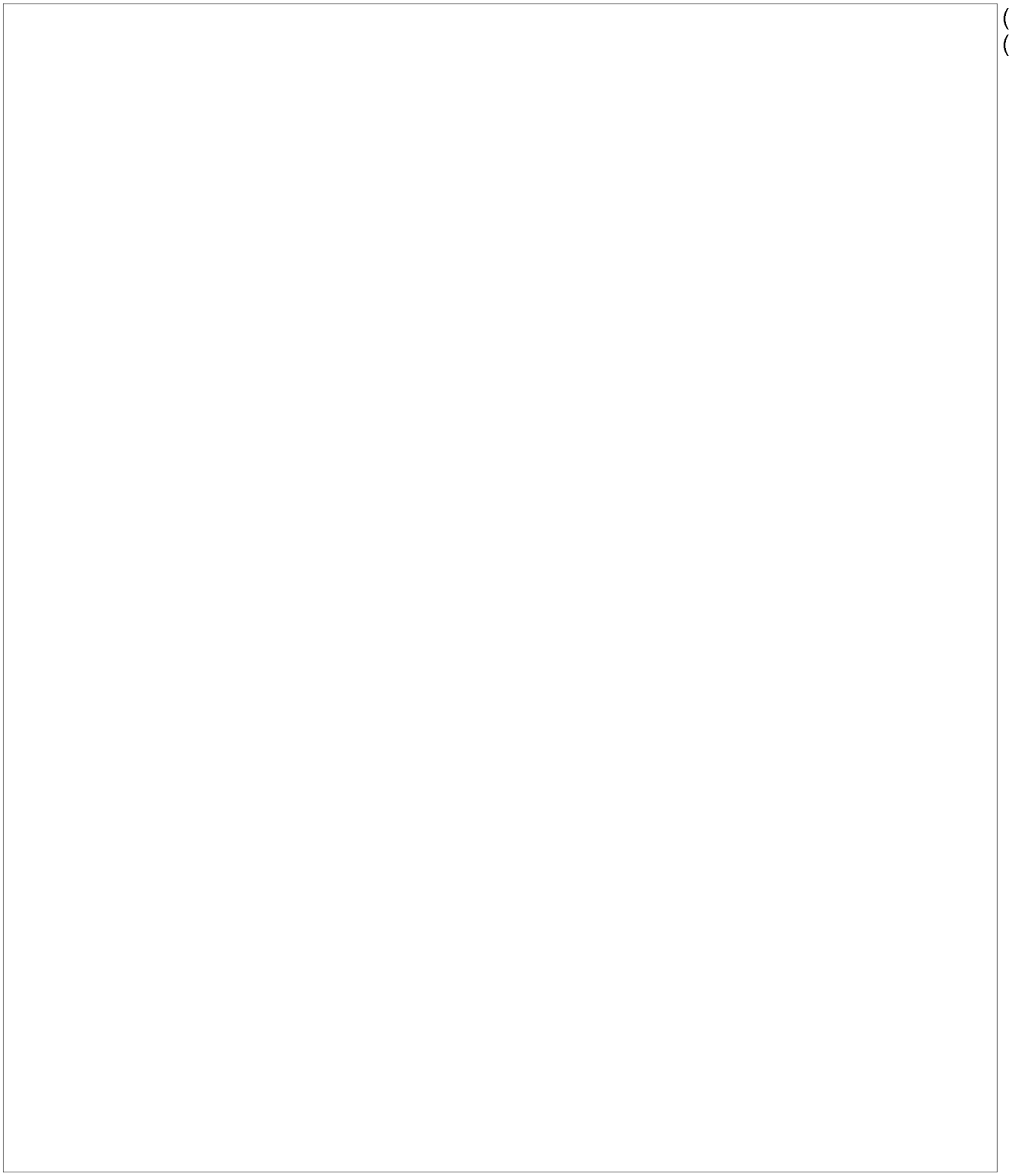

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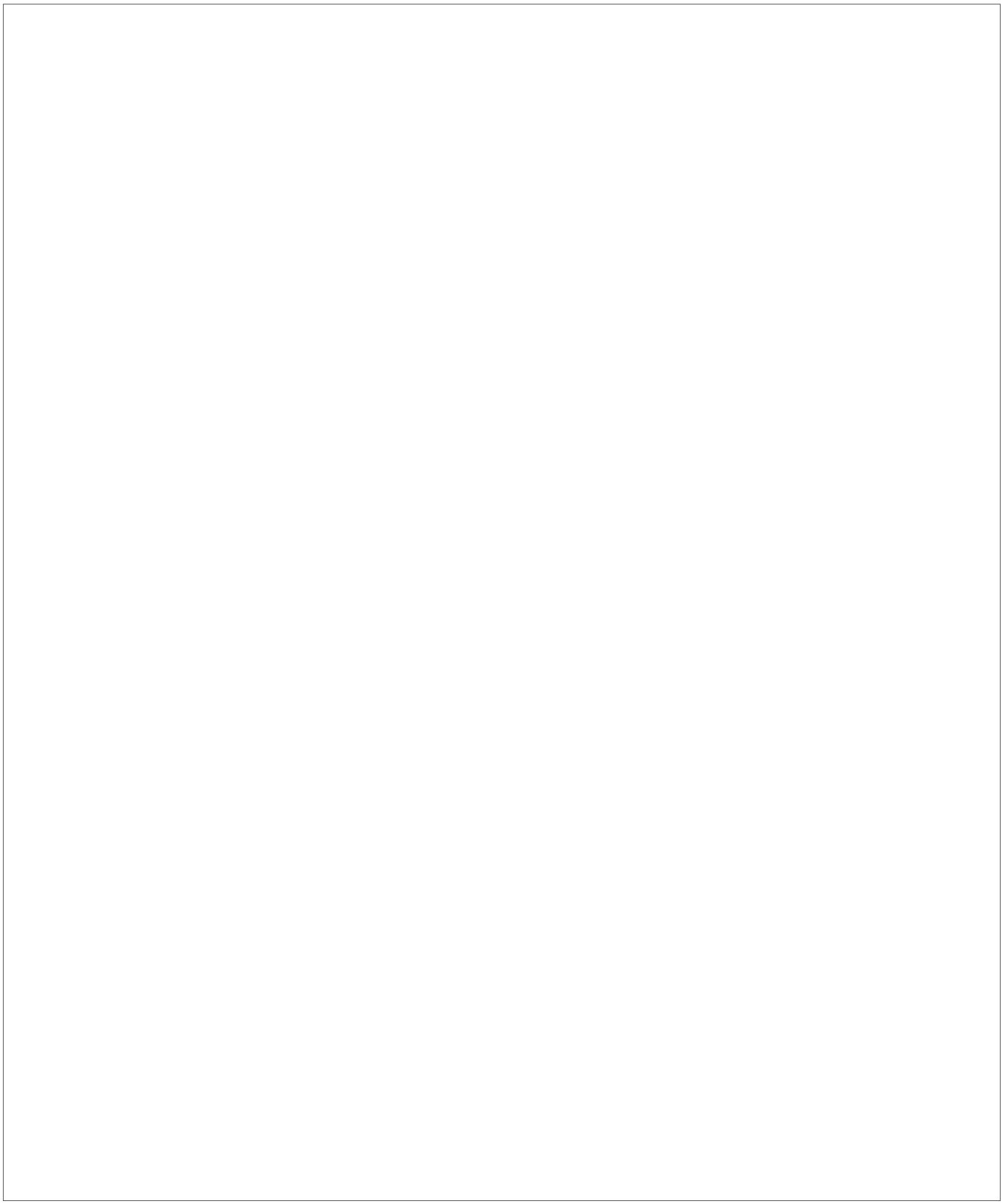

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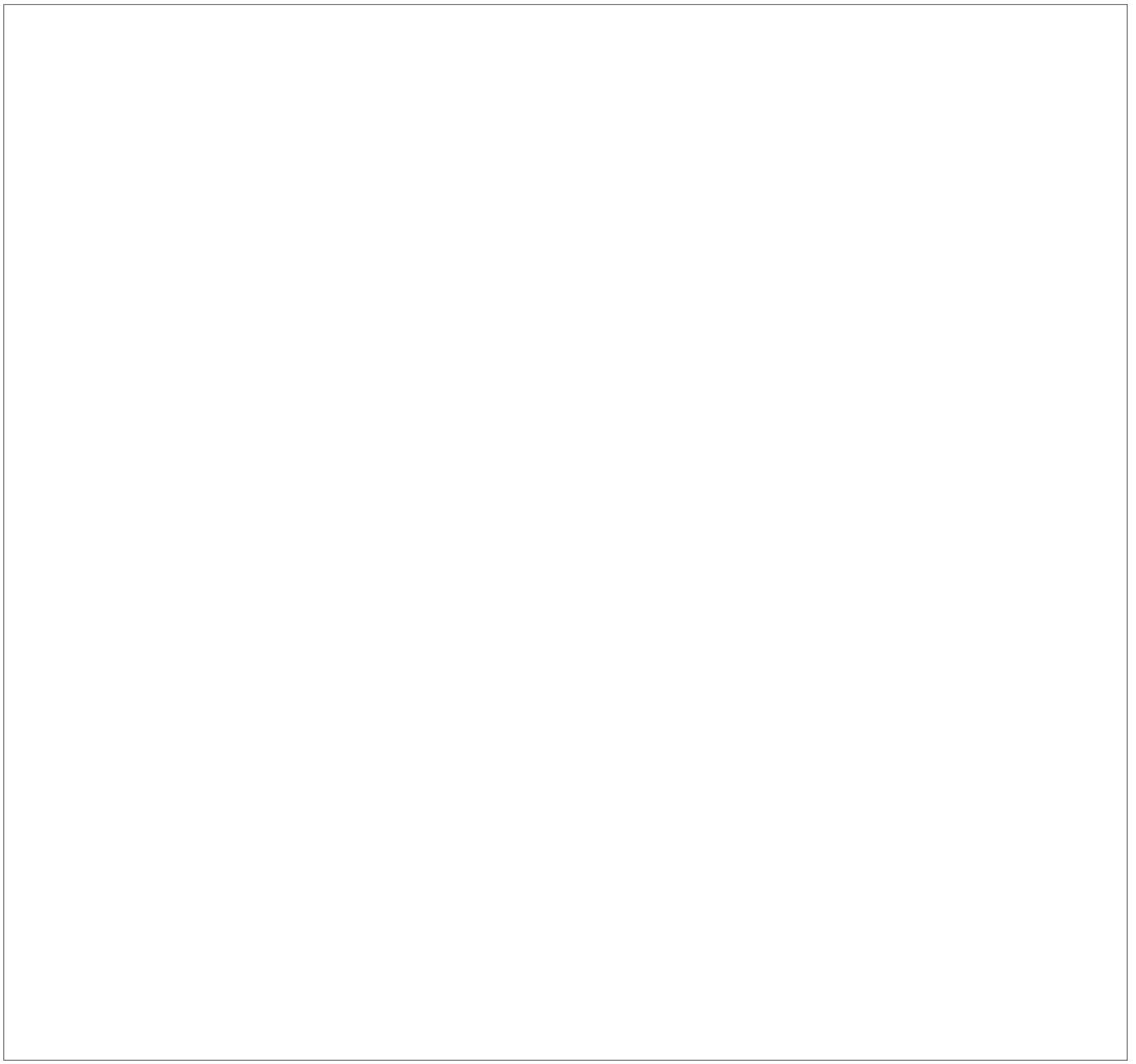

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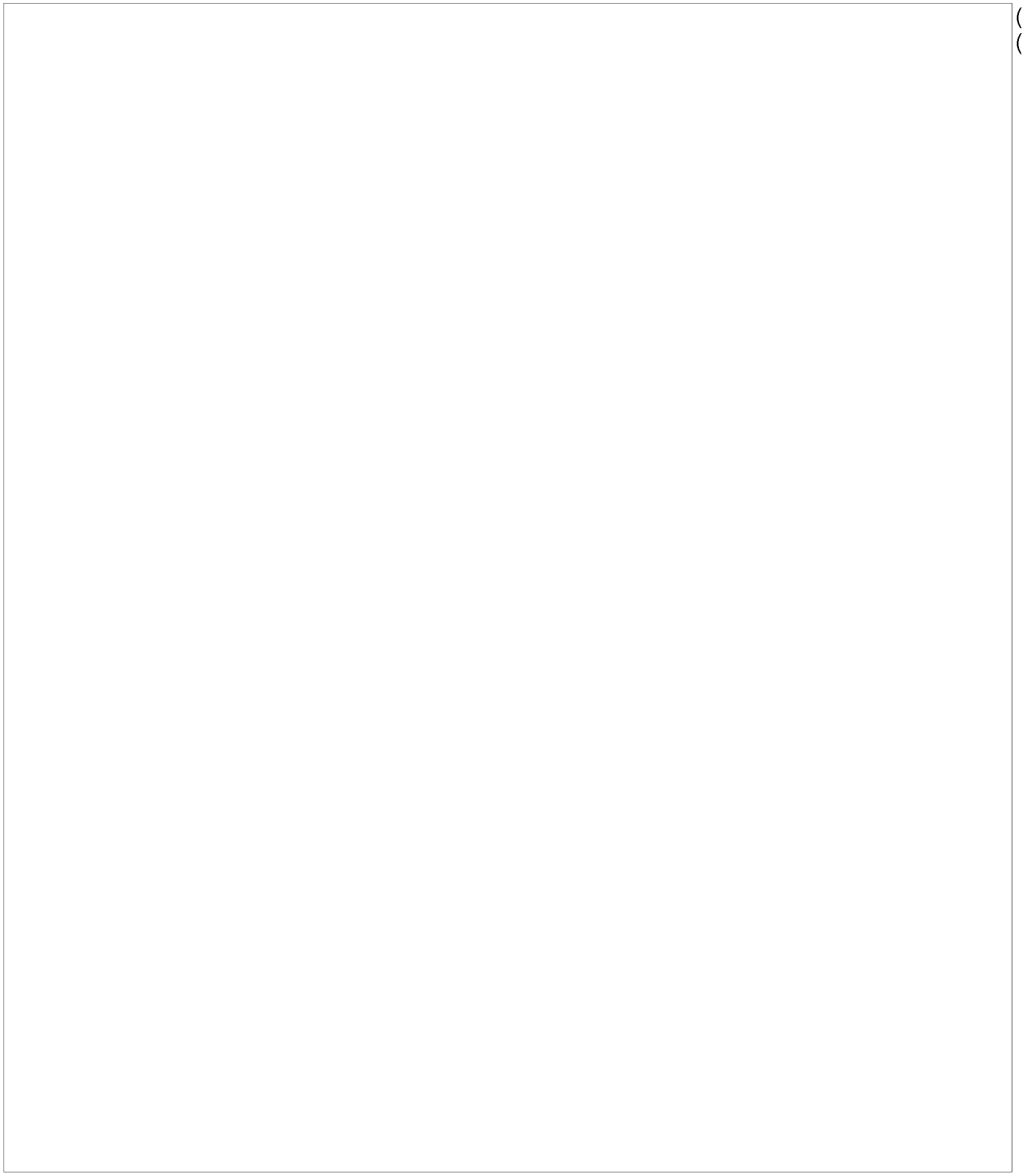

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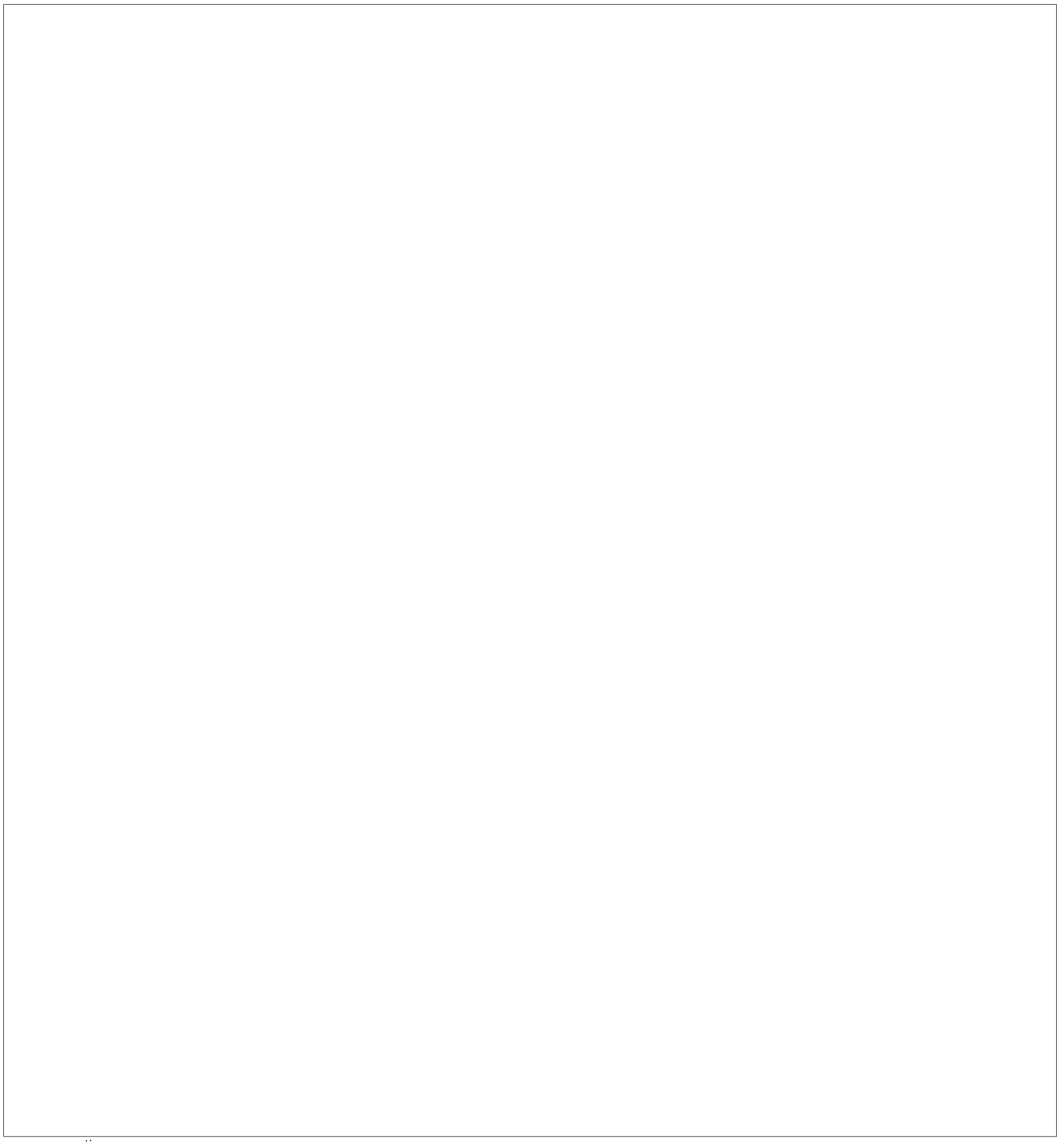

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Conversion of the L-29 to an RPV—Not Difficult!

Conversion of the L-29 to an RPV would require engineers and machinists with basic skill levels, as well as servo-motors, receivers, and data link components suitable for this purpose—no advanced skills, sophisticated systems, or special tooling are required. Iraq possesses all of these requirements (see tables 4 and 5) and may have first acquired the concept from Russia, which has been converting L-29s to UAVs for many years. The requisite engineering and machining expertise, as well as suitable tooling and floor space, are available at the AMC at Rasheed Airbase. In addition, Iraq possesses a variety of out-of-operation aircraft, missiles, and electronic equipment that can be cannibalized or modified for this purpose.

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Flight Controls

The L-29, as well as the L-39, employs a mechanical flight control system with control linkages running from the control column and rudder pedals in the front cockpit, underneath the aft cockpit, to the aircraft's primary flight controls (ailerons, elevator, and rudder). Removal of the pilot seats would have allowed the Iraqis easy access to these linkages, and servos placed in either cockpit were connected to these linkages at joints in the linkages directly underneath each cockpit

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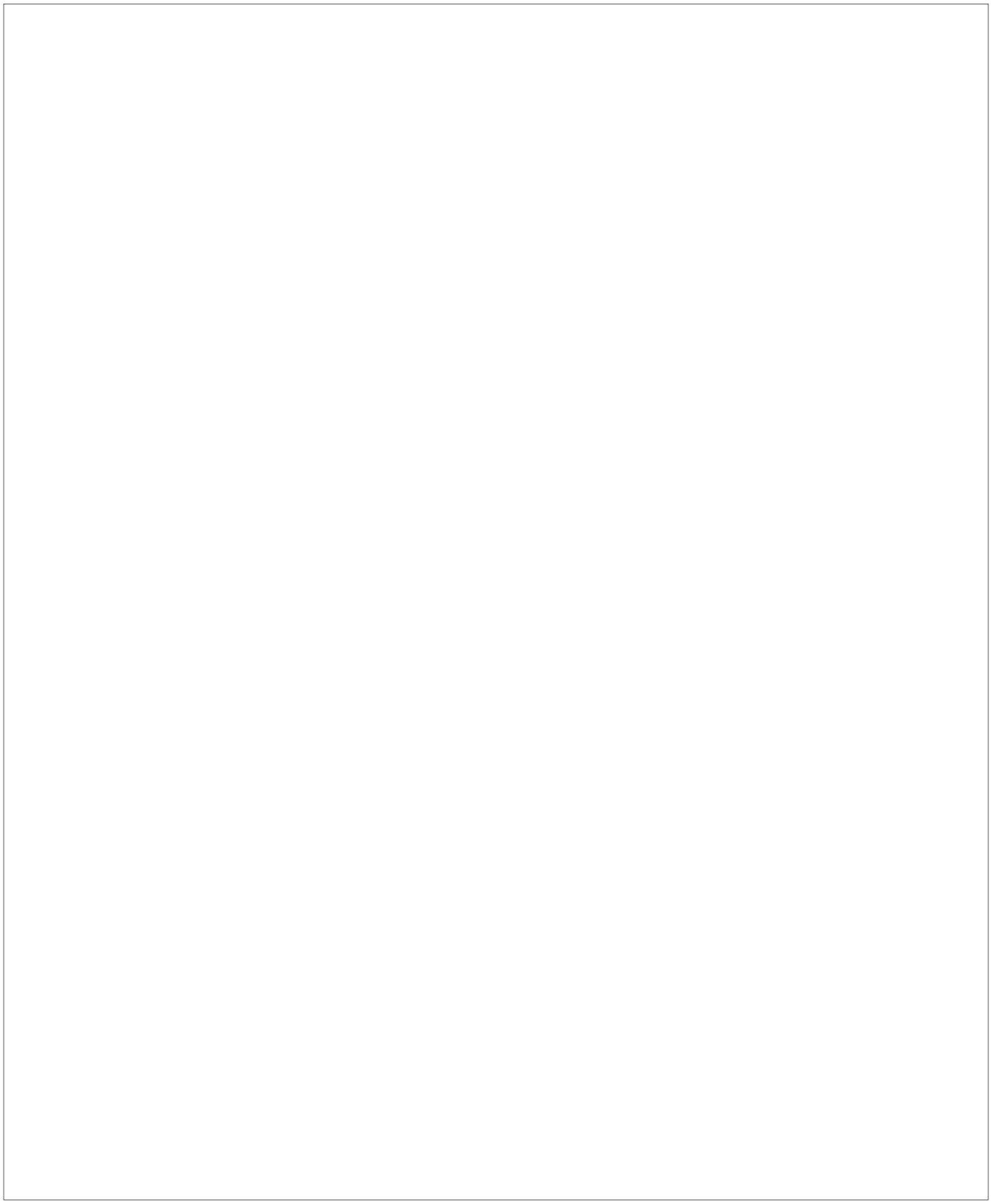

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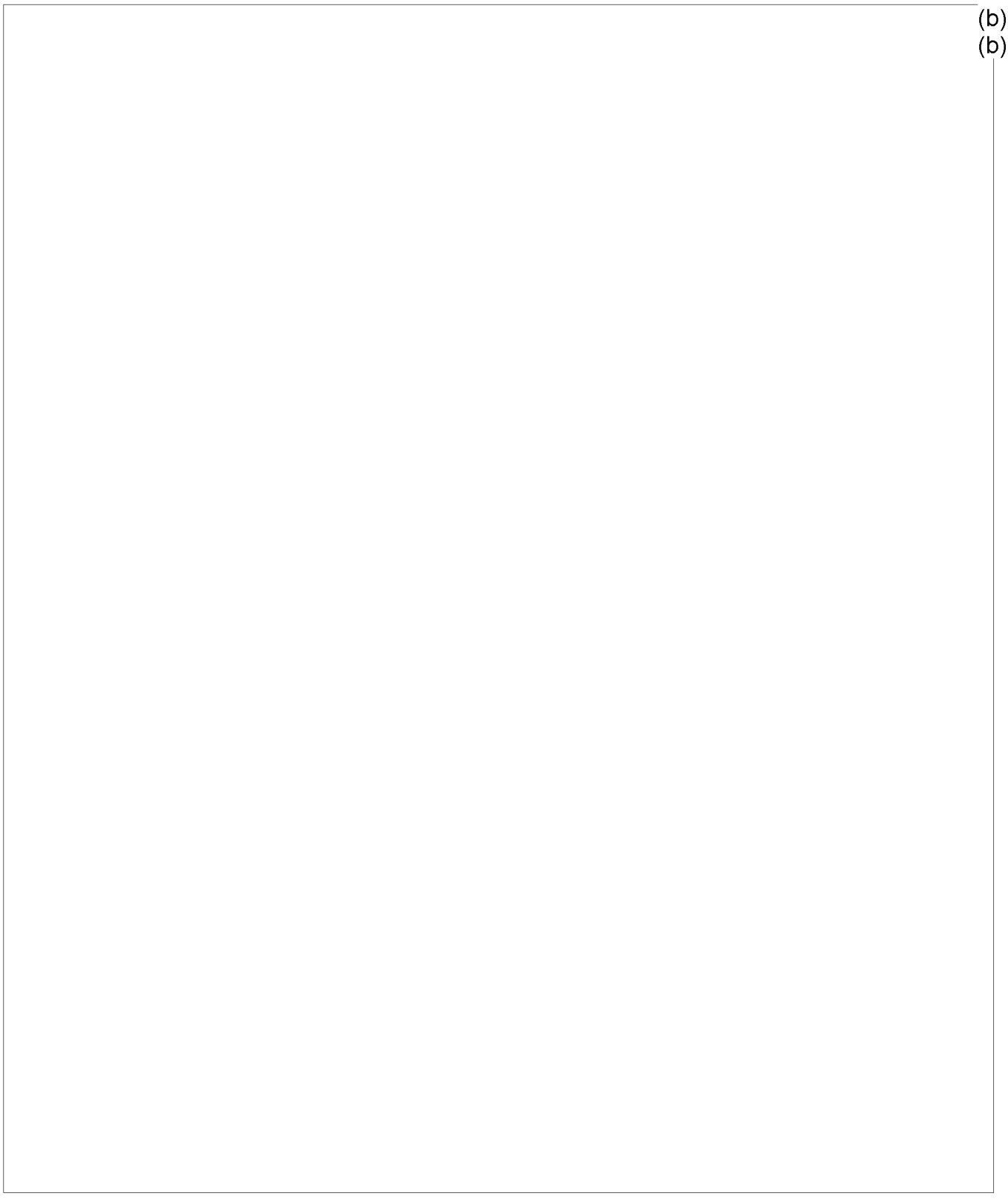

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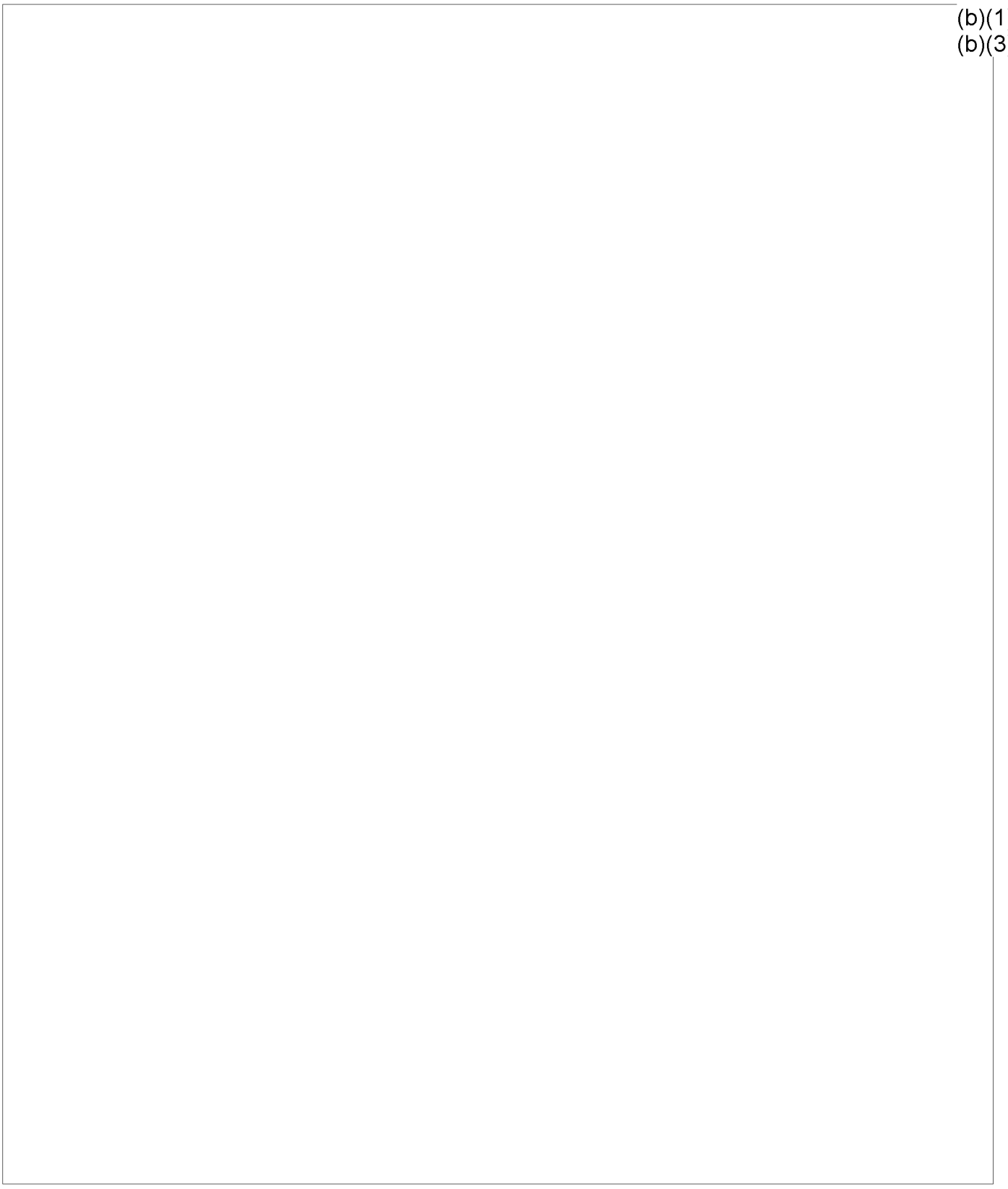

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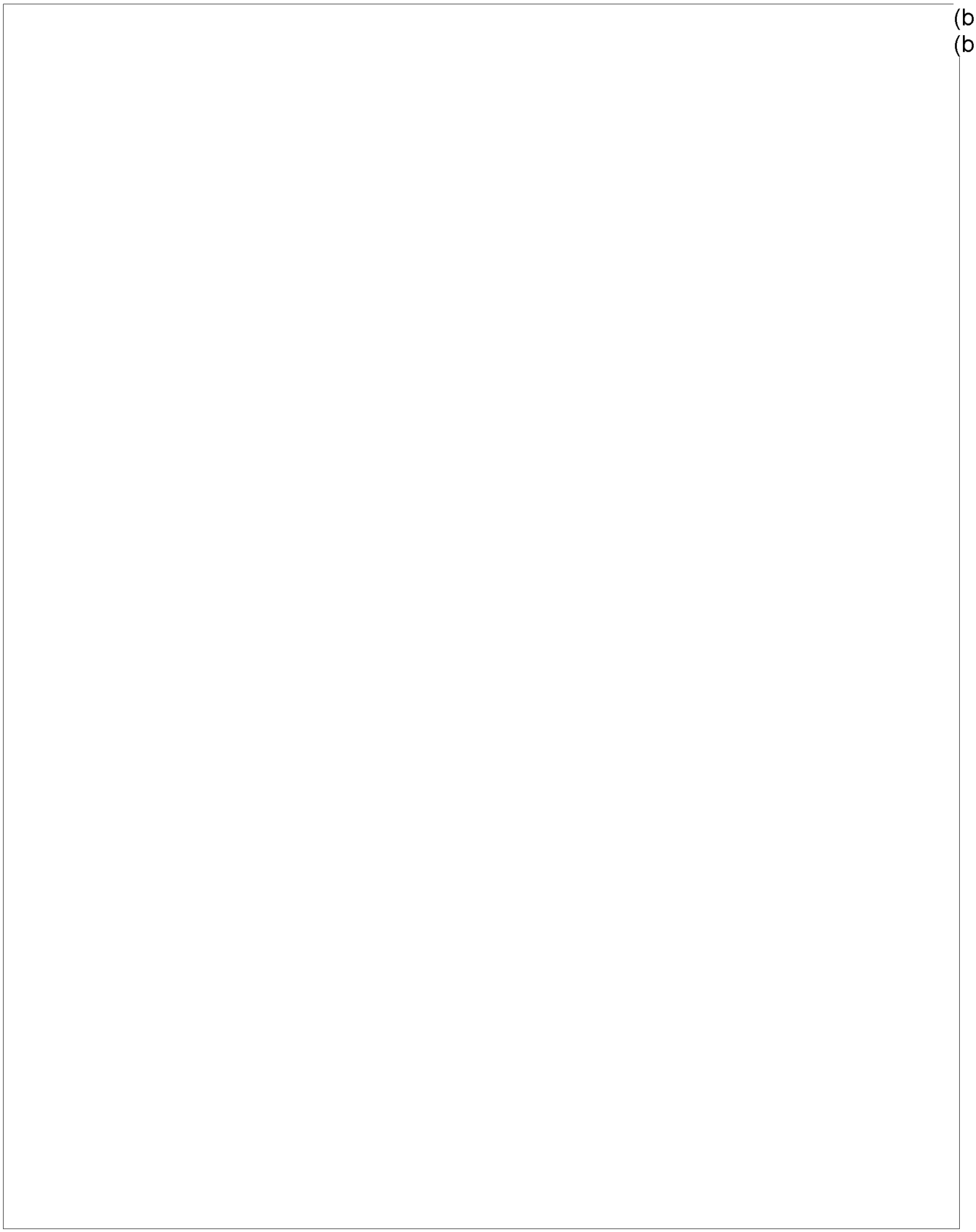
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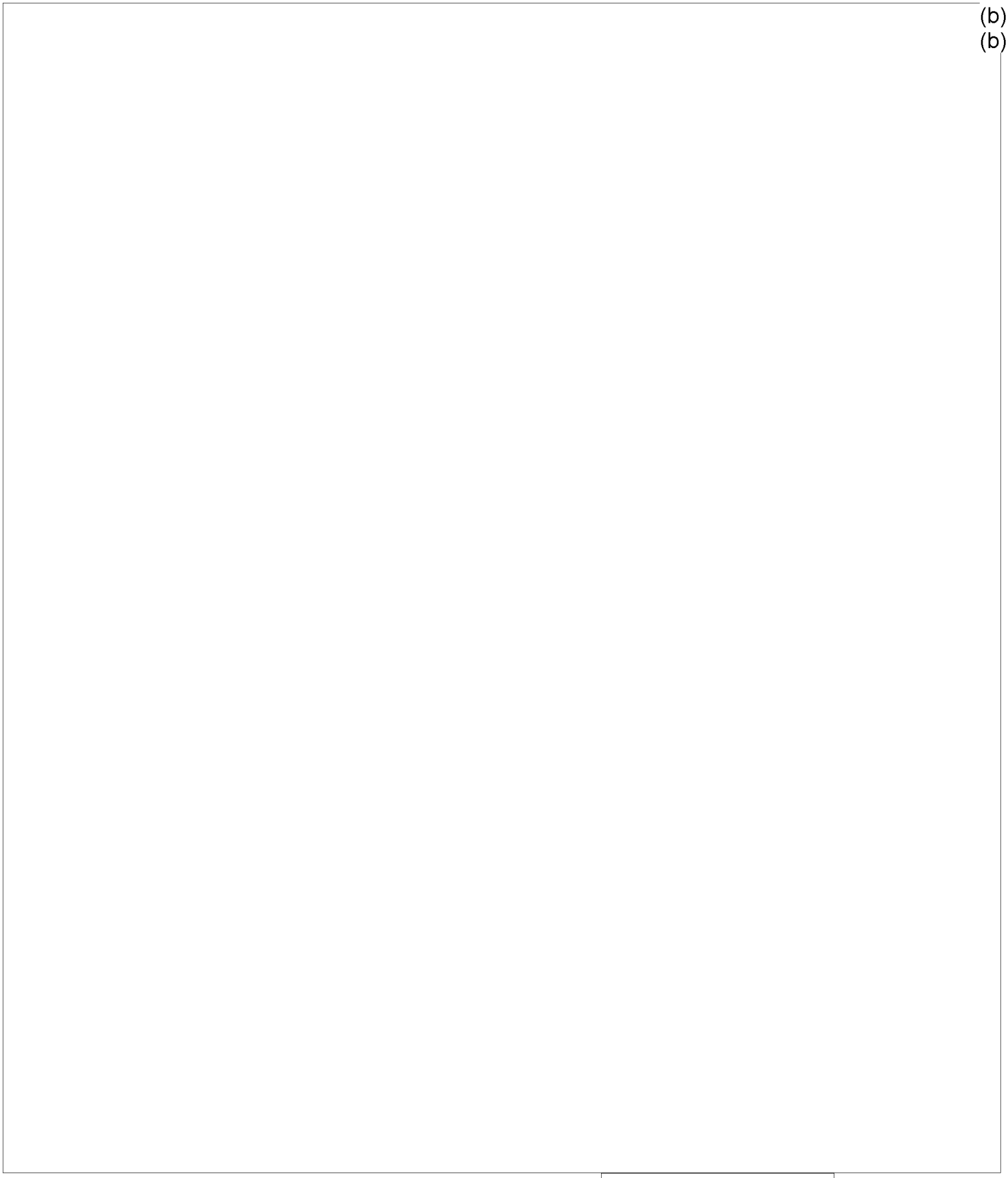

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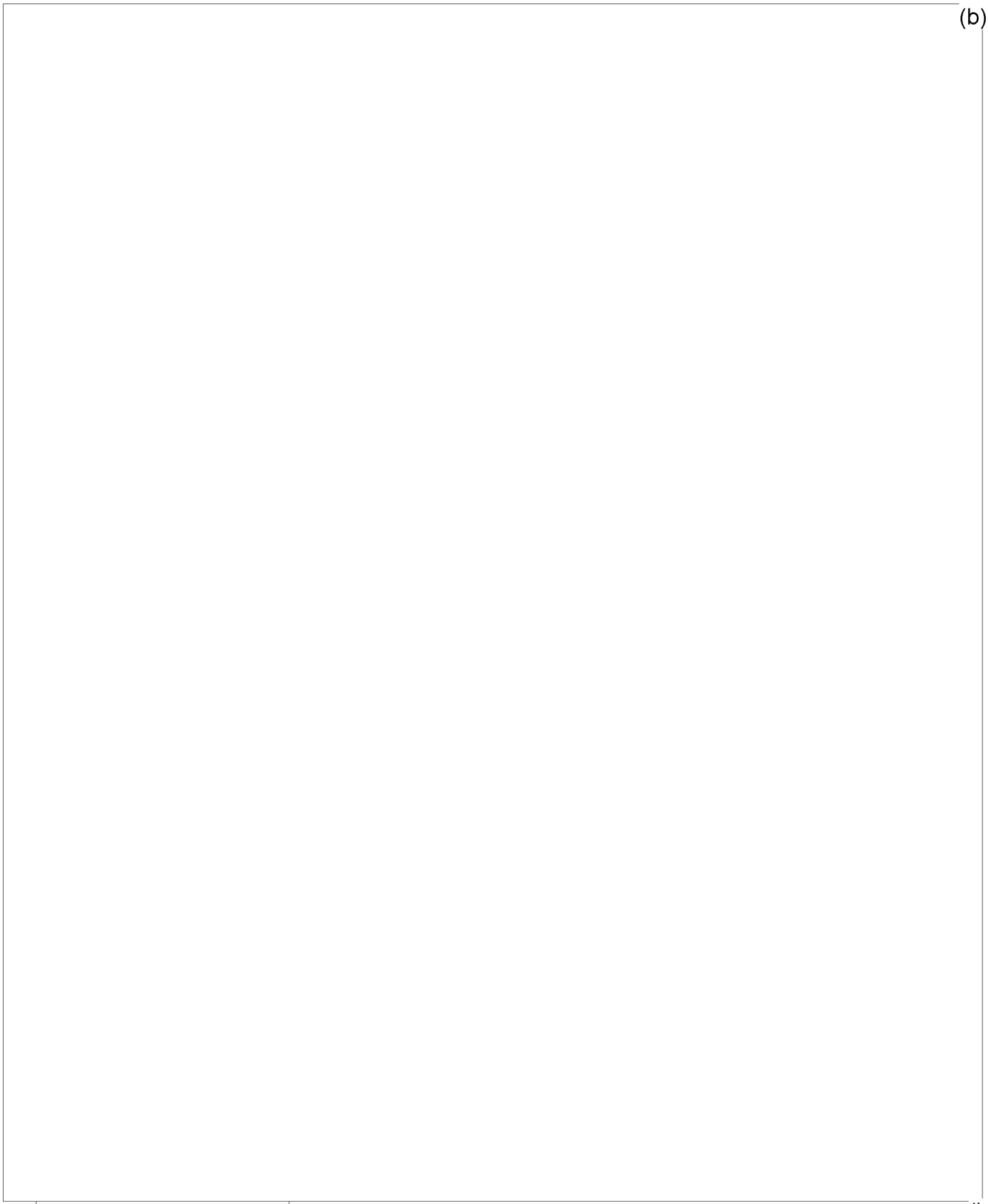

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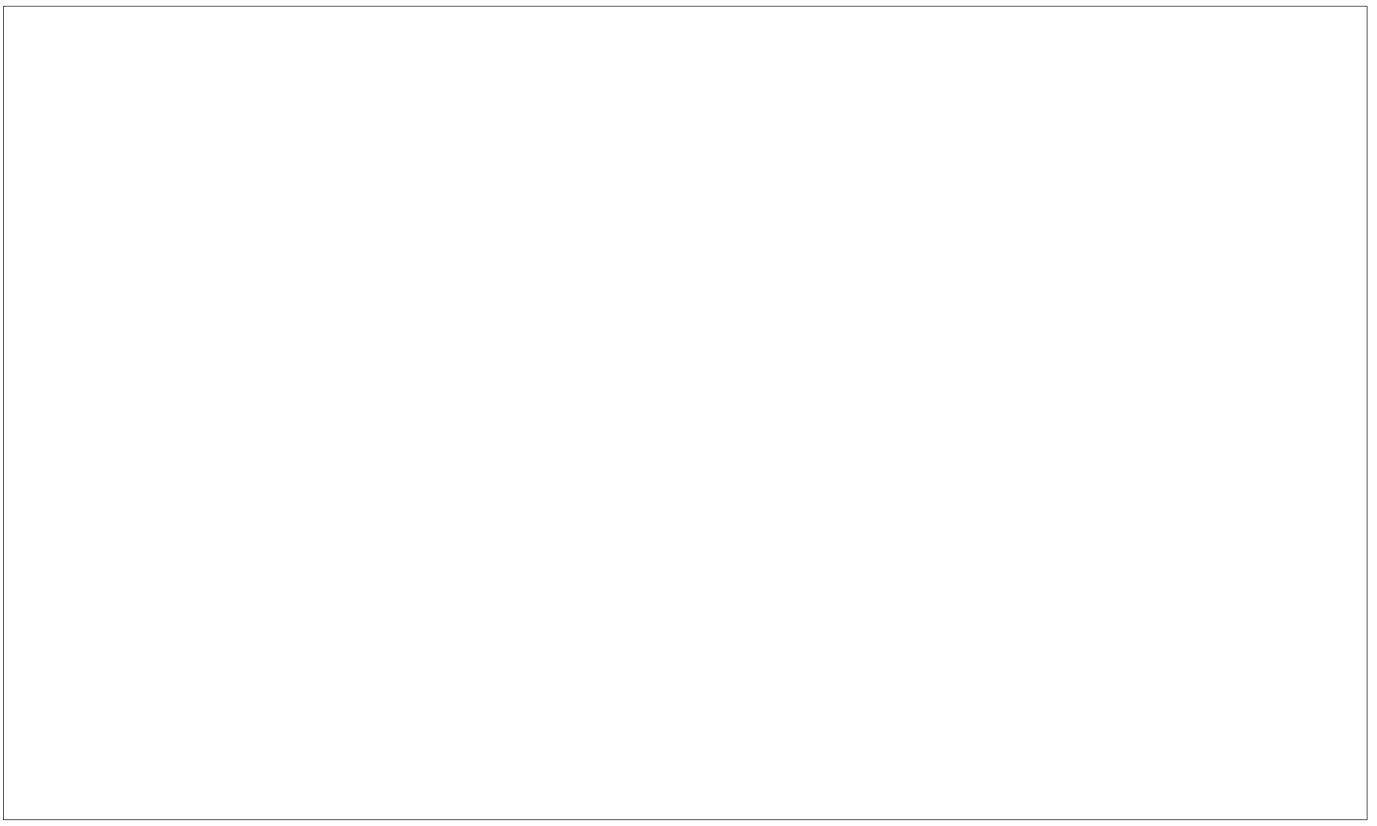

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